非管理版
特機・技術部

NIDEK

AUTOMATIC CHART PROJECTOR

Model CP-690

SERVICE MANUAL

NIDEK CO., LTD.

MCP7**RDA001A/E
Total Page 63

Table of Contents

Page

§1 INTRODUCTION 1-1

§2 CAUTIONS 2-1

§3 TROUBLESHOOTING 3-1

§4 SUB TROUBLESHOOTING 4-1

4.1 The Initialization does not Start. 4-1
4.2 The Motor does not Work. 4-2
4.3 The Motors do not Stop. 4-3
4.4 The Projection Lamp does not Go On. 4-4
4.5 The Chart Image is Partly Blocked. 4-5
4.6 The Chart Brightness is Unsuitable. 4-6
4.7 The Chart Brightness is Uneven. 4-8
4.8 The Chart Image is not Clear. 4-9
4.9 The Chart Image does not Change as Operated by the Remote Control. 4-10
4.10 The Polarized Chart does not Disappear. 4-11
4.11 The LED does not Go On. 4-12

§5 REPLACEMENT 5-1

5.1 How to Remove the Covers 5-1
5.2 Replacement of the Circuit Boards 5-3
5.2.1 Replacement of the BA01 board 5-3
5.2.2 Replacement of the BA02 board 5-4
5.3 Replacement of the Sensors 5-5
5.3.1 Replacement of the chart sensor 5-5
5.3.2 Replacement of the mask sensor 5-6
5.4 Replacement of the Chart Motor 5-7
5.5 Replacement of the Chart ASSY 5-9
5.6 Replacement of the Mask Motor and Mask ASSY 5-11
5.7 Replacement of the Bottom Cover ASSY (Power LED) 5-13
5.8 Replacement of the Power Switch 5-13
5.9 Replacement of the Power Transformer 5-14

Page
5.10 Replacement of the C lens ASSY, Lamp Cable and Reflecting Mirror 5-15
5.11 Replacement of the Holder ASSY 5-17
5.12 Replacement of the Halogen Lamp 5-18
5.13 Replacement of the Fuses 5-18
5.14 Cleaning 5-19
5.14.1 Cleaning of the chart and mask 5-19
5.14.2 Cleaning of the halogen lamp, reflecting mirror and condenser lens 5-20
5.14.3 Cleaning of the holder ASSY 5-21

§6 ADJUSTEMENT 6-1
6.1 Adjustment of the Initialized Position 6-1
6.2 Adjustment of the Sensor Voltage 6-2
6.3 Adjustment of the Lamp Filament Position 6-3
6.4 Adjustment of the Fixed Mask Position 6-4
6.5 Adjustment of the Chart and Mask Positions 6-5
6.6 Setting 6-6
6.6.1 Setting of the voltage sensor 6-6
6.6.2 To display or not display the visual acuity 6-7
6.6.3 Selecting the amount of chart light 6-8
6.6.4 Setting of the beep sound volume (Response sound) 6-8
6.6.5 Setting of the DIP switch 6-9

§7 INFORMATION 7-1
7.1 Wiring Diagram 7-1
7.2 How to Carry Out the Wiring 7-5

§8 LIST OF REPLACEABLE PARTS 8-1

§9 TOOLS AND MEASURING DEVICES 9-1

§1 INTRODUCTION

This service manual provides information for after-sales service of the NIDEK Automatic Chart Projector Model CP-690.

For proper after-sales service, it is necessary to understand this manual thoroughly before servicing.

Refer to "CP-690 Operator's manual".

Specifications are subject to change without notice for improvement. As for important changes, refer to Technical Bulletins.

In case the instrument cannot be repaired by procedures described in this manual, please tell us the serial number of the instrument and details of the symptom or symptoms.

§2 CAUTIONS

<Before service>

- Only service personnel, who are used to handling tools and are familiar with this instrument, can perform the servicing.

- Perform the servicing according to the procedures described in this manual. If not, an unexpected accident or a failure may be caused.

- Before maintenance, unless "Turn the power switch ON" is written, be sure to turn the power switch OFF and unplug the power cord from the wall outlet.

- Pay attention not to perform the servicing with moist hands. This may cause an electric shock or a failure.

<During service>

- If a malfunction occurs, check the symptom and turn the power switch OFF.

- Once the lamp goes on, its surroundings become hot. Do not touch parts near the lamp while it is lit or just after the light goes off.

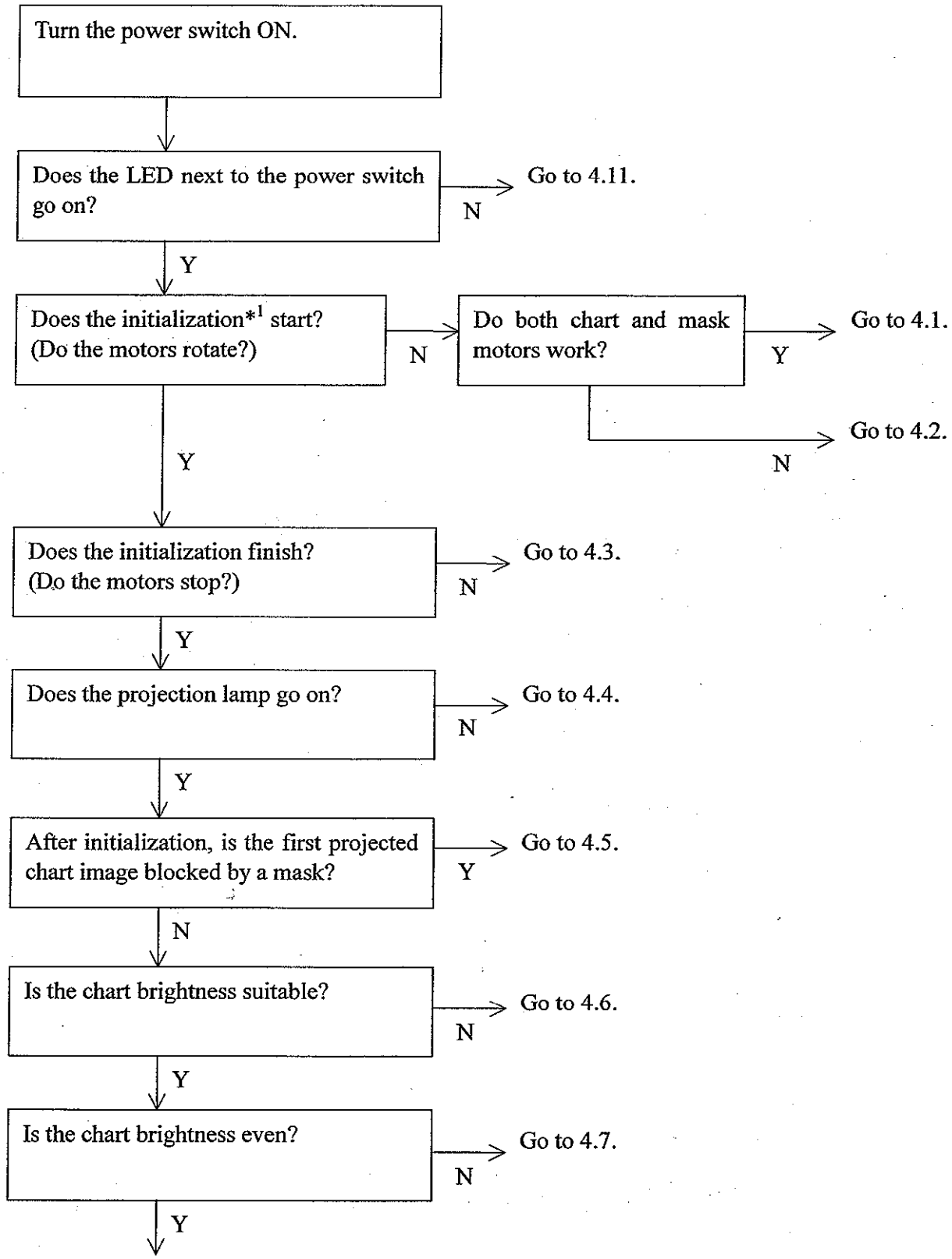
- When handling circuit boards, be sure to touch only parts indicated in this manual. If not, an electric shock or a failure may be caused.

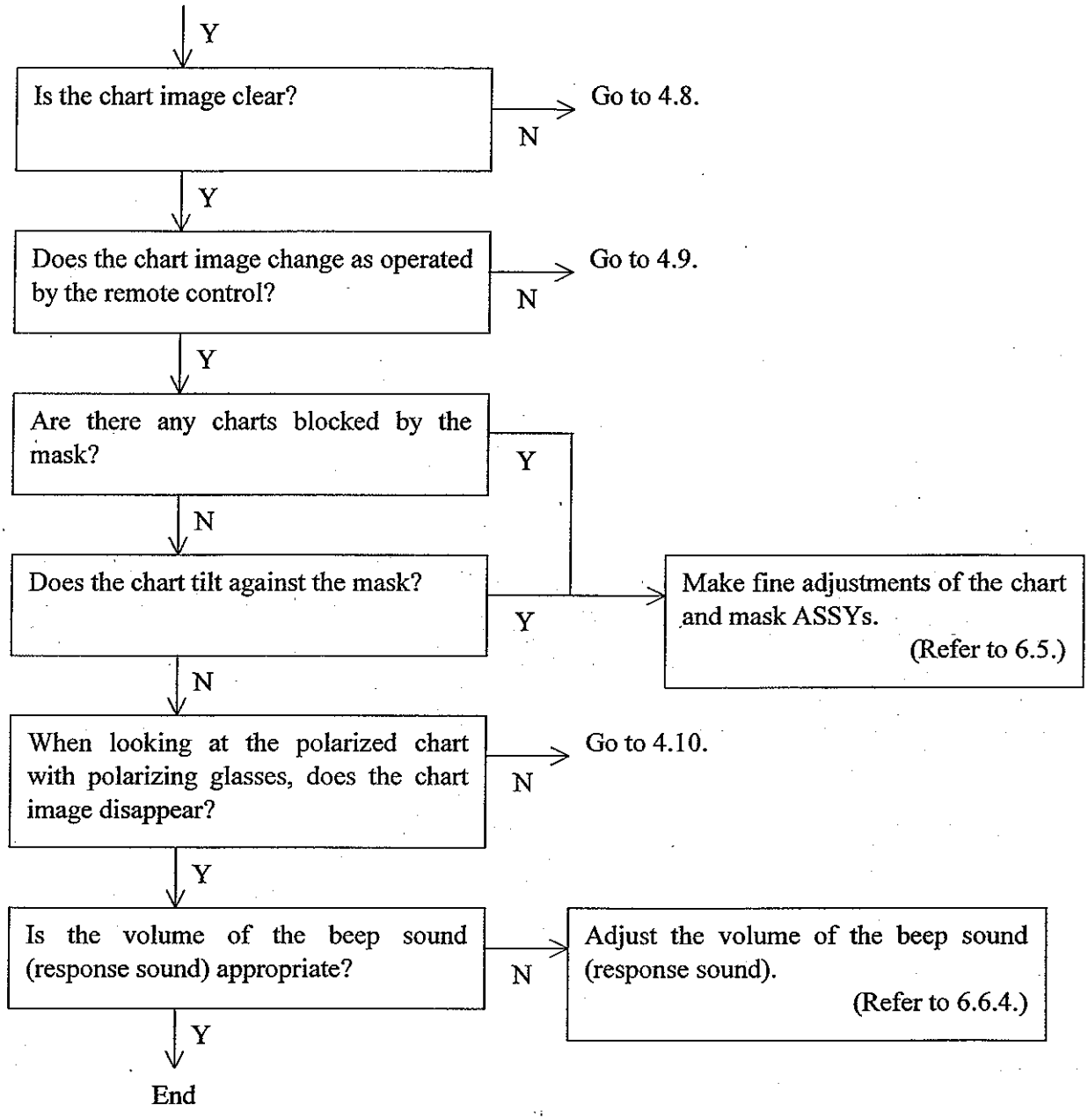
- In case the instrument produces smoke or an unusual odor, turn the power switch OFF immediately and then unplug the power cord from the wall outlet.
  Do not use the instrument in abnormal conditions. This may cause an electric shock or a fire.

- Do not lose or drop the screws, parts, etc. inside the instrument.
  As for the parts which are easy to lose, prepare a case beforehand and store the parts in it.

- If the screws, to which a threadlocking adhesive has been applied, are loosened, apply a threadlocking adhesive to the screws after re-tightening them.

- The following words are used in §4 SUB TROUBLESHOOTING.
  – Power voltage check –
  ① Plug the power cord and turn the power switch ON.
  ② Measure the voltage of the confirmed points with a tester (selecting voltage).
  – Continuity check –
  ① Turn the power switch OFF and unplug the power cord.
  ② Measure the resistance of the confirmed points with the tester (selecting resistance).
  – Cable check (Check of poor contact) –
  ① Turn the power switch OFF and unplug the power cord.
  ② Check that the connectors are inserted correctly. (Refer to §7 WIRING DIAGRAM.)
  ③ Reconnect the connectors and then check that there are no poor contacts in the connectors.
  ④ Measure the resistance of the confirmed points in a broken cable with the tester (selecting resistance).

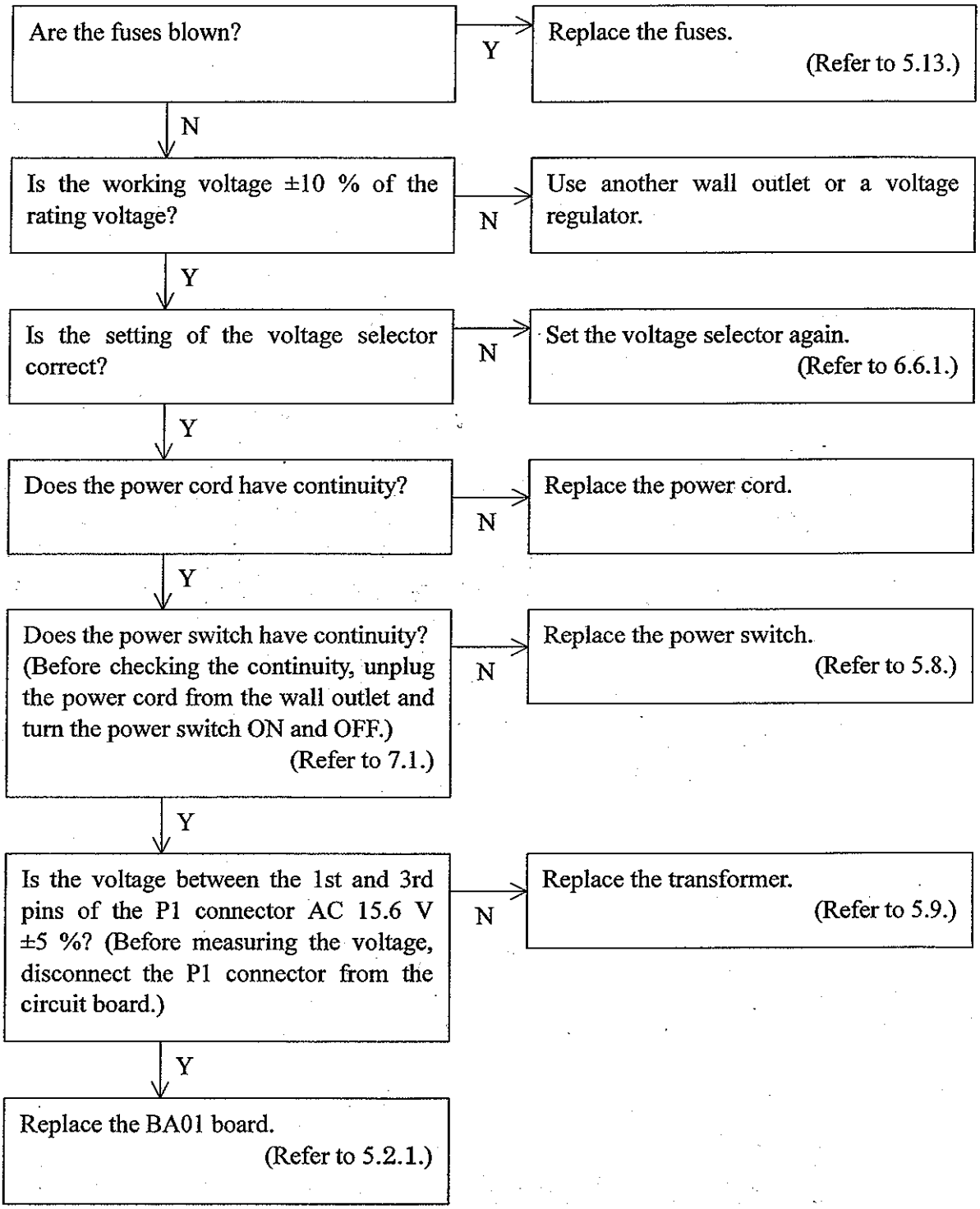

Turn the power switch ON.
Does the LED next to the power switch go on?
N
Go to 4.11.
Y
Does the initialization*1 start? (Do the motors rotate?)
N
Do both chart and mask motors work?
Y
Go to 4.1.
N
Go to 4.2.
Y
Does the initialization finish? (Do the motors stop?)
N
Go to 4.3.
Y
Does the projection lamp go on?
N
Go to 4.4.
Y
After initialization, is the first projected chart image blocked by a mask?
Y
Go to 4.5.
N
Is the chart brightness suitable?
N
Go to 4.6.
Y
Is the chart brightness even?
N
Go to 4.7.
Y



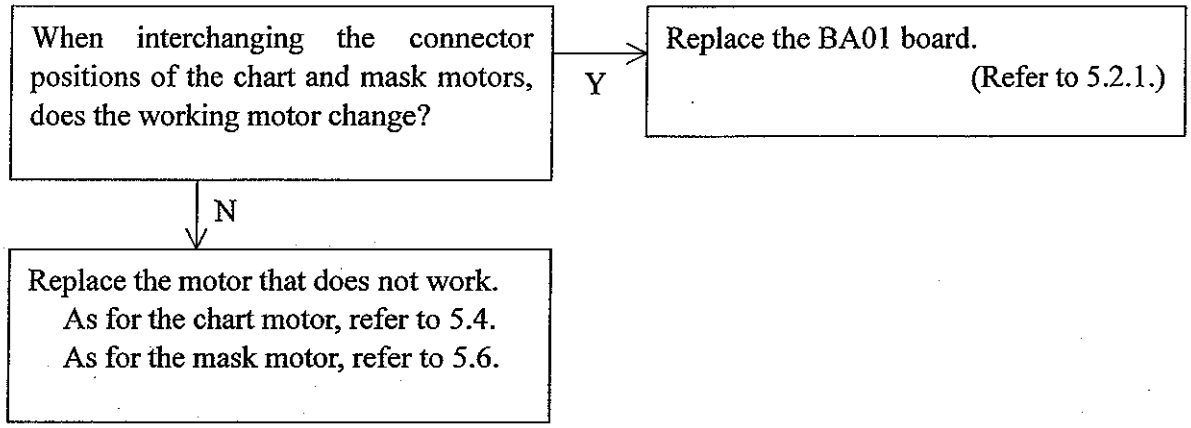
*1 The initialization performs the following operations.

1) The chart ASSY rotates and then stops by the sensor.
2) The chart ASSY moves little by little to correct its position.
3) The mask ASSY rotates and then stops by the sensor.
4) The mask ASSY moves little by little to correct its position.
5) The projection lamp goes on. The first chart is presented.

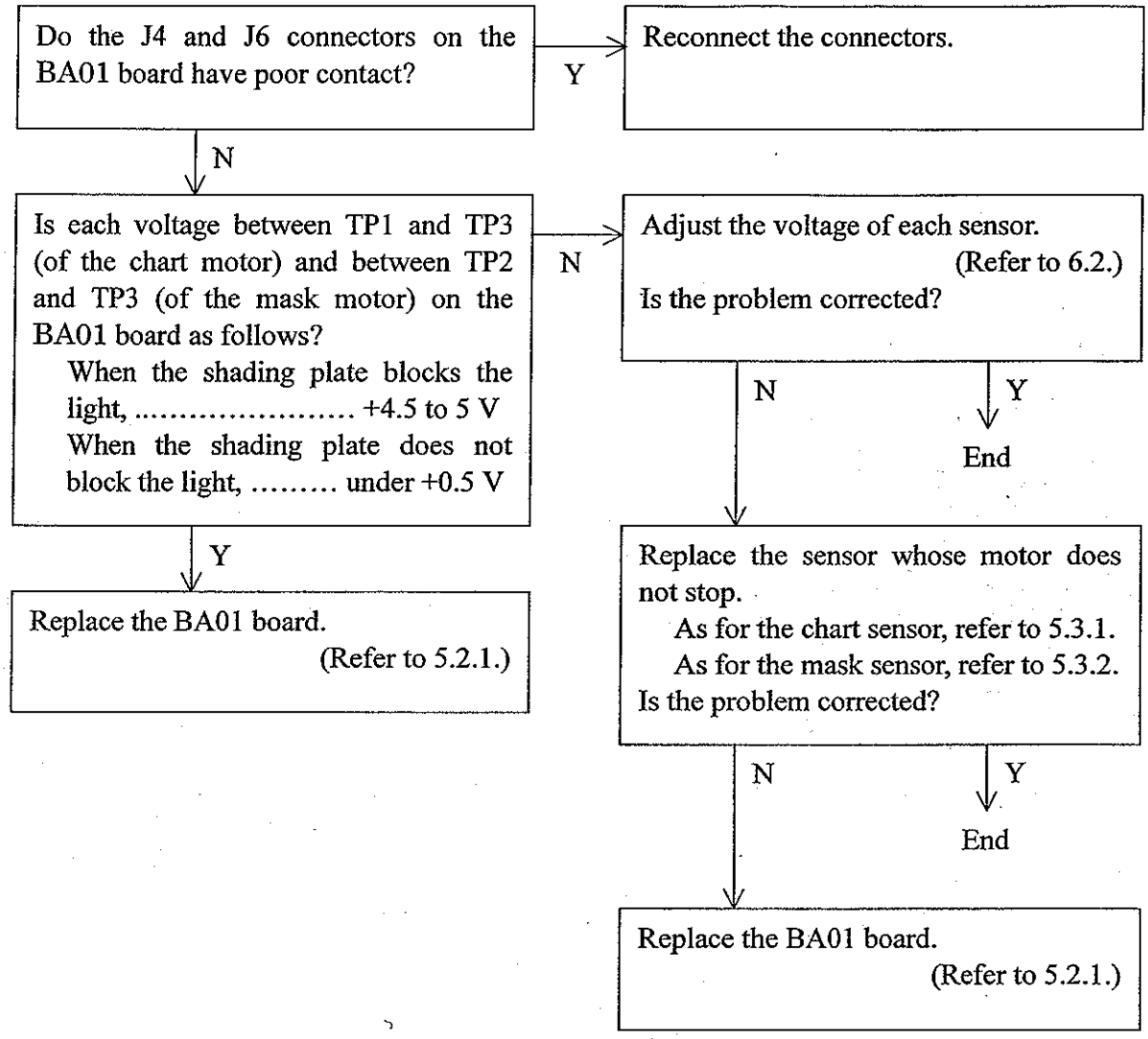
4.1 The Initialization does not Start.


Are the fuses blown?
Y
Replace the fuses.
(Refer to 5.13.)
N
Is the working voltage ±10 % of the rating voltage?
N
Use another wall outlet or a voltage regulator.
Y
Is the setting of the voltage selector correct?
N
Set the voltage selector again.
(Refer to 6.6.1.)
Y
Does the power cord have continuity?
N
Replace the power cord.
Y
Does the power switch have continuity? (Before checking the continuity, unplug the power cord from the wall outlet and turn the power switch ON and OFF.)
(Refer to 7.1.)
N
Replace the power switch.
(Refer to 5.8.)
Y
Is the voltage between the 1st and 3rd pins of the P1 connector AC 15.6 V ±5 %? (Before measuring the voltage, disconnect the P1 connector from the circuit board.)
N
Replace the transformer.
(Refer to 5.9.)
Y
Replace the BA01 board.
(Refer to 5.2.1.)

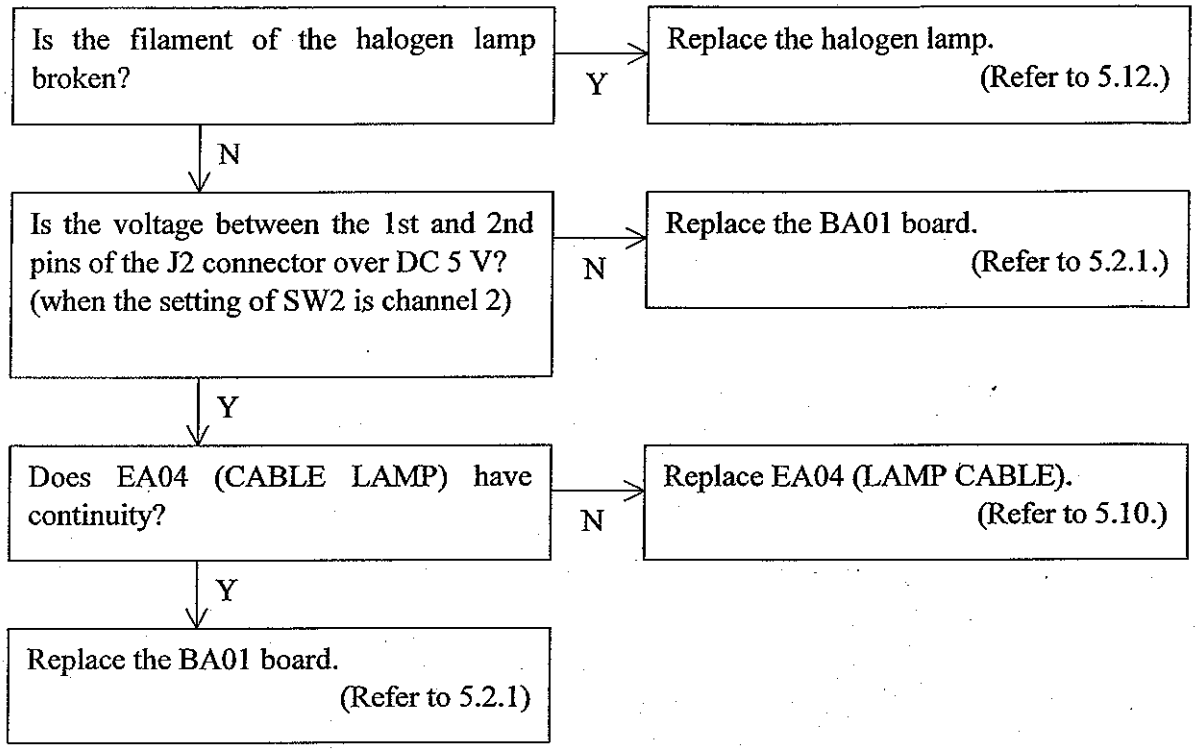
4.2 The Motor does not Work.


When interchanging the connector positions of the chart and mask motors, does the working motor change?
Y
Replace the BA01 board.
(Refer to 5.2.1.)
N
Replace the motor that does not work.
As for the chart motor, refer to 5.4.
As for the mask motor, refer to 5.6.

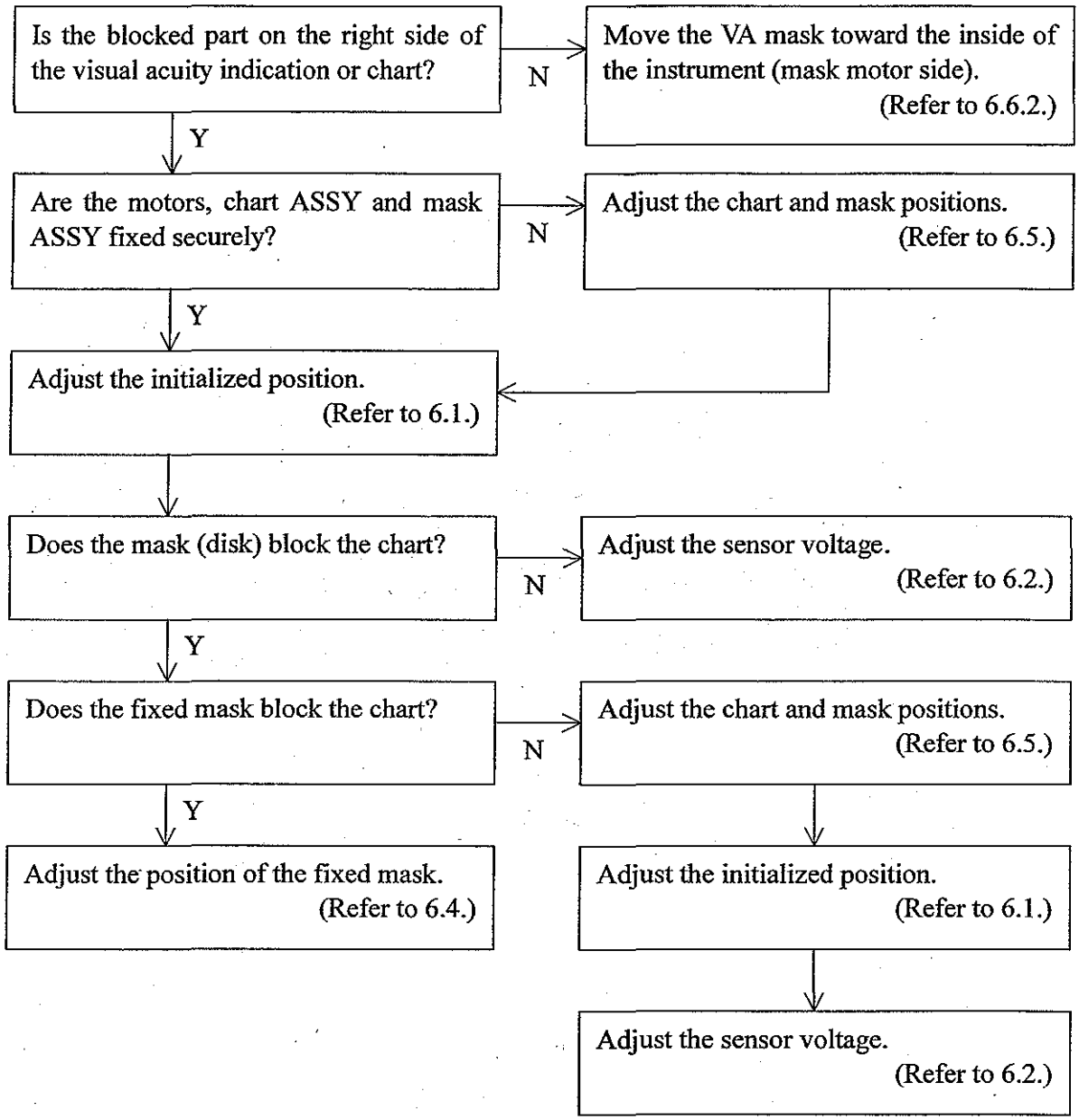
4.3 The Motors do not Stop.


Do the J4 and J6 connectors on the BA01 board have poor contact?
Y
Reconnect the connectors.
N
Is each voltage between TP1 and TP3 (of the chart motor) and between TP2 and TP3 (of the mask motor) on the BA01 board as follows?
When the shading plate blocks the light, ... +4.5 to 5 V
When the shading plate does not block the light, ... under +0.5 V
N
Adjust the voltage of each sensor.
(Refer to 6.2.)
Is the problem corrected?
N
Y
End
Y
Replace the BA01 board.
(Refer to 5.2.1.)
Replace the sensor whose motor does not stop.
As for the chart sensor, refer to 5.3.1.
As for the mask sensor, refer to 5.3.2.
Is the problem corrected?
N
Y
End
Replace the BA01 board.
(Refer to 5.2.1.)

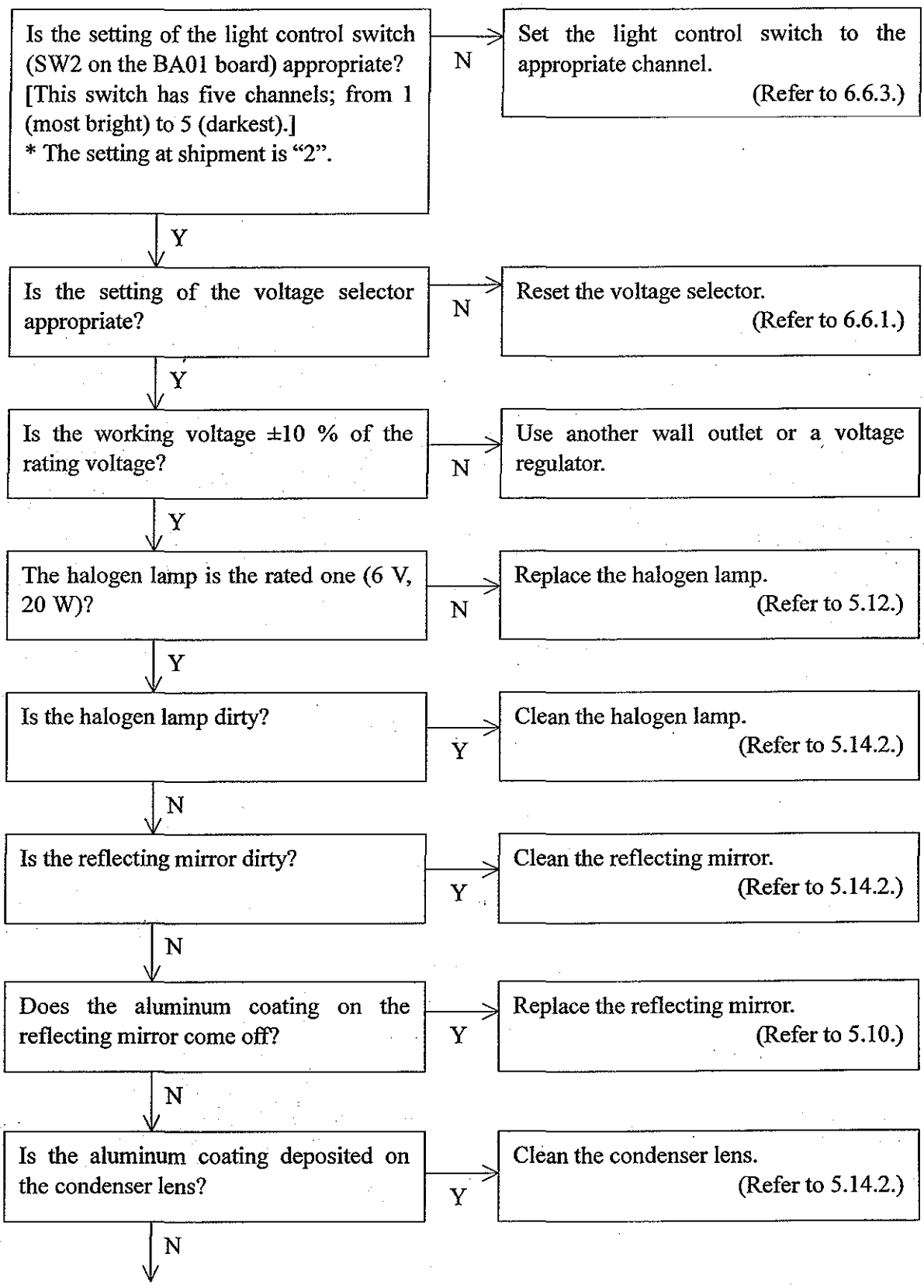
4.4 The Projection Lamp does not Go On.

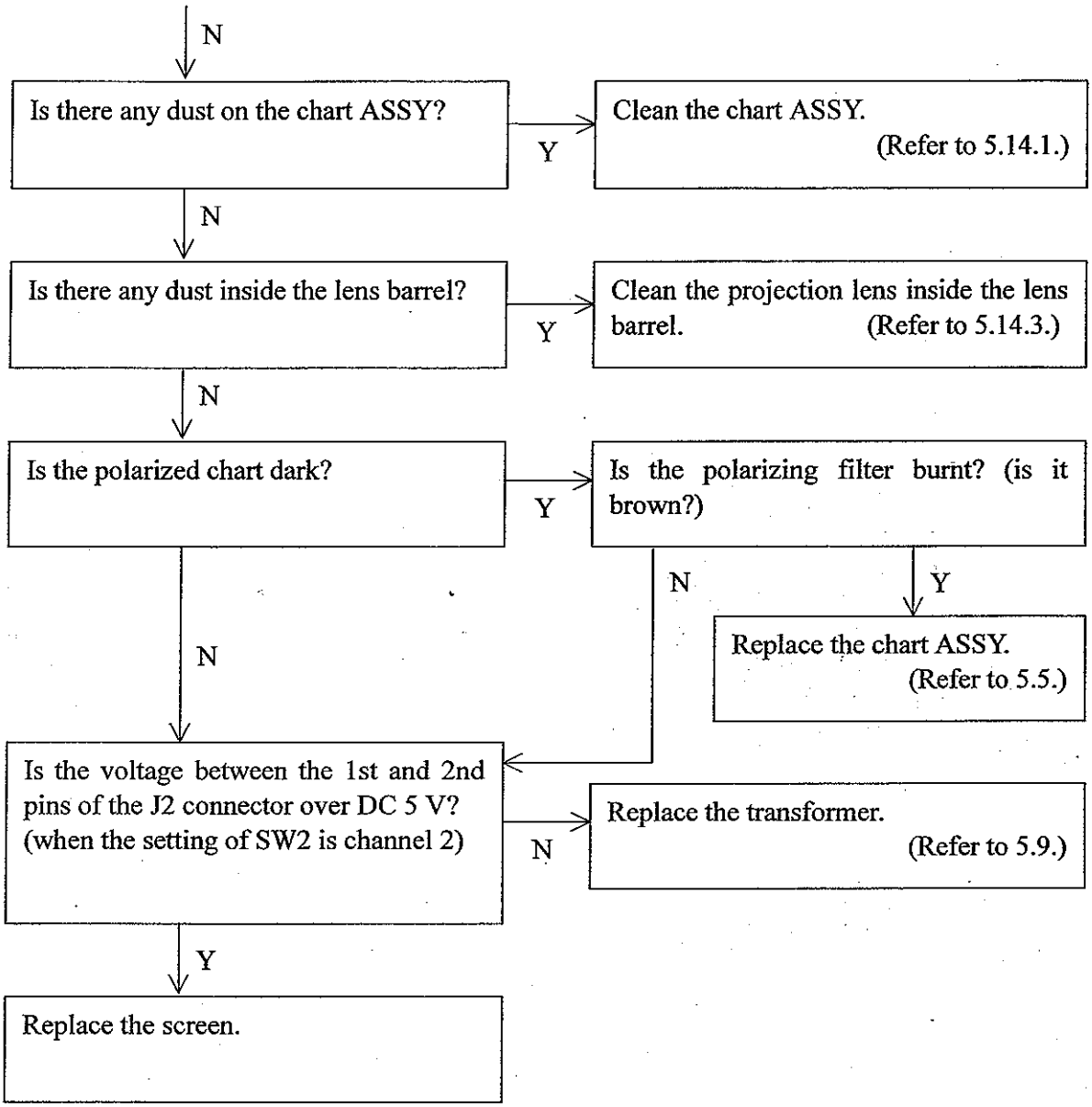

Is the filament of the halogen lamp broken?
Y
Replace the halogen lamp.
(Refer to 5.12.)
N
Is the voltage between the 1st and 2nd pins of the J2 connector over DC 5 V? (when the setting of SW2 is channel 2)
N
Replace the BA01 board.
(Refer to 5.2.1.)
Y
Does EA04 (CABLE LAMP) have continuity?
N
Replace EA04 (LAMP CABLE).
(Refer to 5.10.)
Y
Replace the BA01 board.
(Refer to 5.2.1)

4.5 The Chart Image is Partly Blocked.

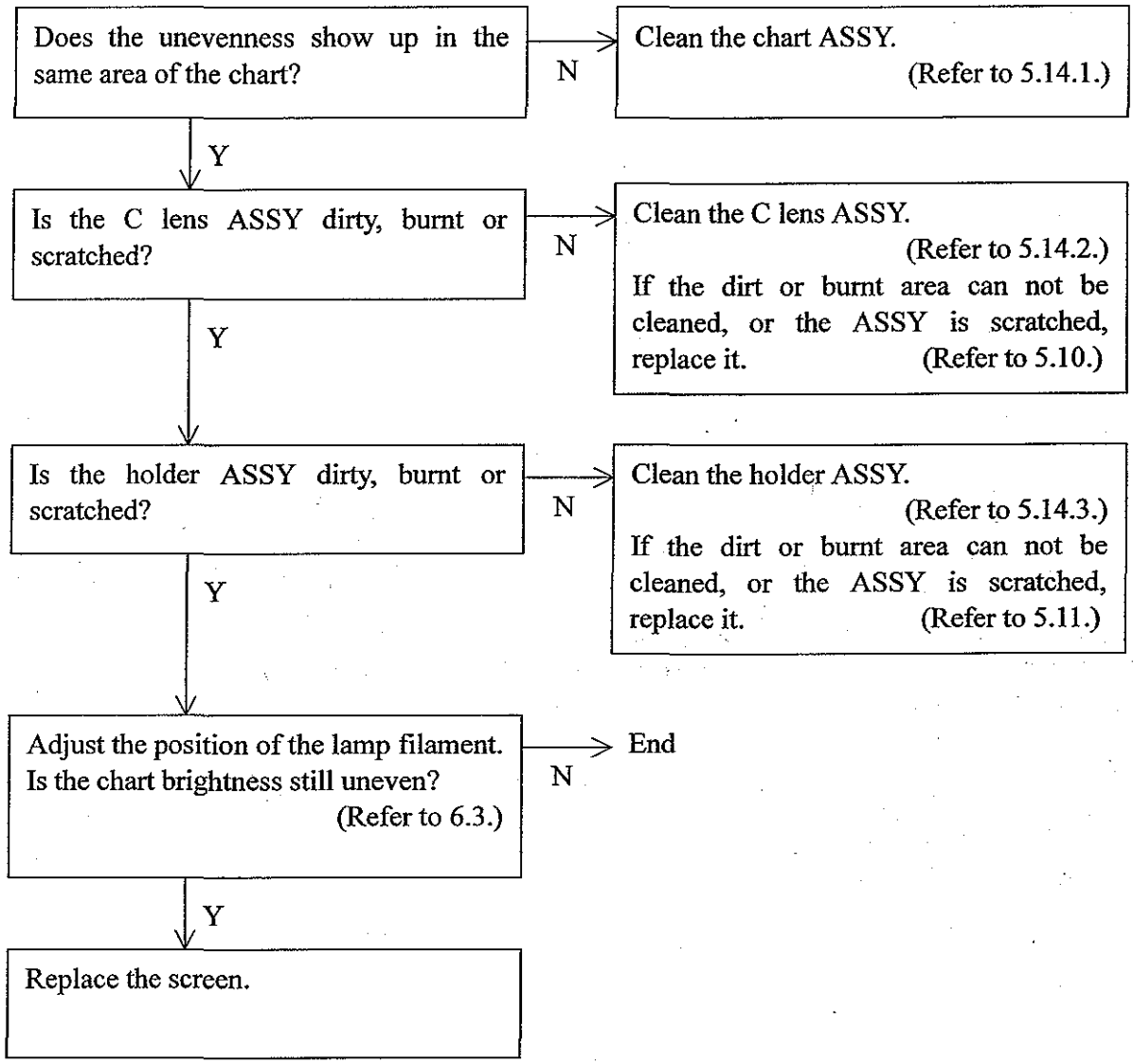

Is the blocked part on the right side of the visual acuity indication or chart?
N
Move the VA mask toward the inside of the instrument (mask motor side).
(Refer to 6.6.2.)
Y
Are the motors, chart ASSY and mask ASSY fixed securely?
N
Adjust the chart and mask positions.
(Refer to 6.5.)
Y
Adjust the initialized position.
(Refer to 6.1.)
Does the mask (disk) block the chart?
N
Adjust the sensor voltage.
(Refer to 6.2.)
Y
Does the fixed mask block the chart?
N
Adjust the chart and mask positions.
(Refer to 6.5.)
Y
Adjust the position of the fixed mask.
(Refer to 6.4.)
Adjust the initialized position.
(Refer to 6.1.)
Adjust the sensor voltage.
(Refer to 6.2.)

4.6 The Chart Brightness is Unsuitable.

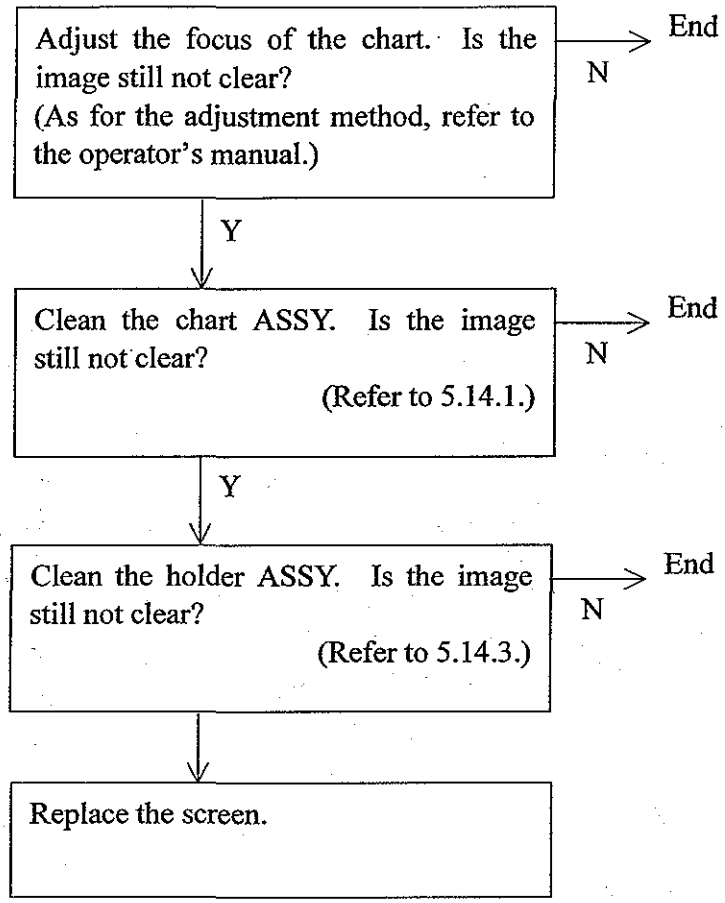

Is the setting of the light control switch (SW2 on the BA01 board) appropriate? [This switch has five channels; from 1 (most bright) to 5 (darkest).] * The setting at shipment is "2".
N
Set the light control switch to the appropriate channel. (Refer to 6.6.3.)
Y
Is the setting of the voltage selector appropriate?
N
Reset the voltage selector. (Refer to 6.6.1.)
Y
Is the working voltage ±10 % of the rating voltage?
N
Use another wall outlet or a voltage regulator.
Y
The halogen lamp is the rated one (6 V, 20 W)?
N
Replace the halogen lamp. (Refer to 5.12.)
Y
Is the halogen lamp dirty?
Y
Clean the halogen lamp. (Refer to 5.14.2.)
N
Is the reflecting mirror dirty?
Y
Clean the reflecting mirror. (Refer to 5.14.2.)
N
Does the aluminum coating on the reflecting mirror come off?
Y
Replace the reflecting mirror. (Refer to 5.10.)
N
Is the aluminum coating deposited on the condenser lens?
Y
Clean the condenser lens. (Refer to 5.14.2.)
N


N
Is there any dust on the chart ASSY?
Y
Clean the chart ASSY.
(Refer to 5.14.1.)
N
Is there any dust inside the lens barrel?
Y
Clean the projection lens inside the lens barrel. (Refer to 5.14.3.)
N
Is the polarized chart dark?
Y
Is the polarizing filter burnt? (is it brown?)
N
Y
Replace the chart ASSY.
(Refer to 5.5.)
N
Is the voltage between the 1st and 2nd pins of the J2 connector over DC 5 V? (when the setting of SW2 is channel 2)
N
Replace the transformer.
(Refer to 5.9.)
Y
Replace the screen.

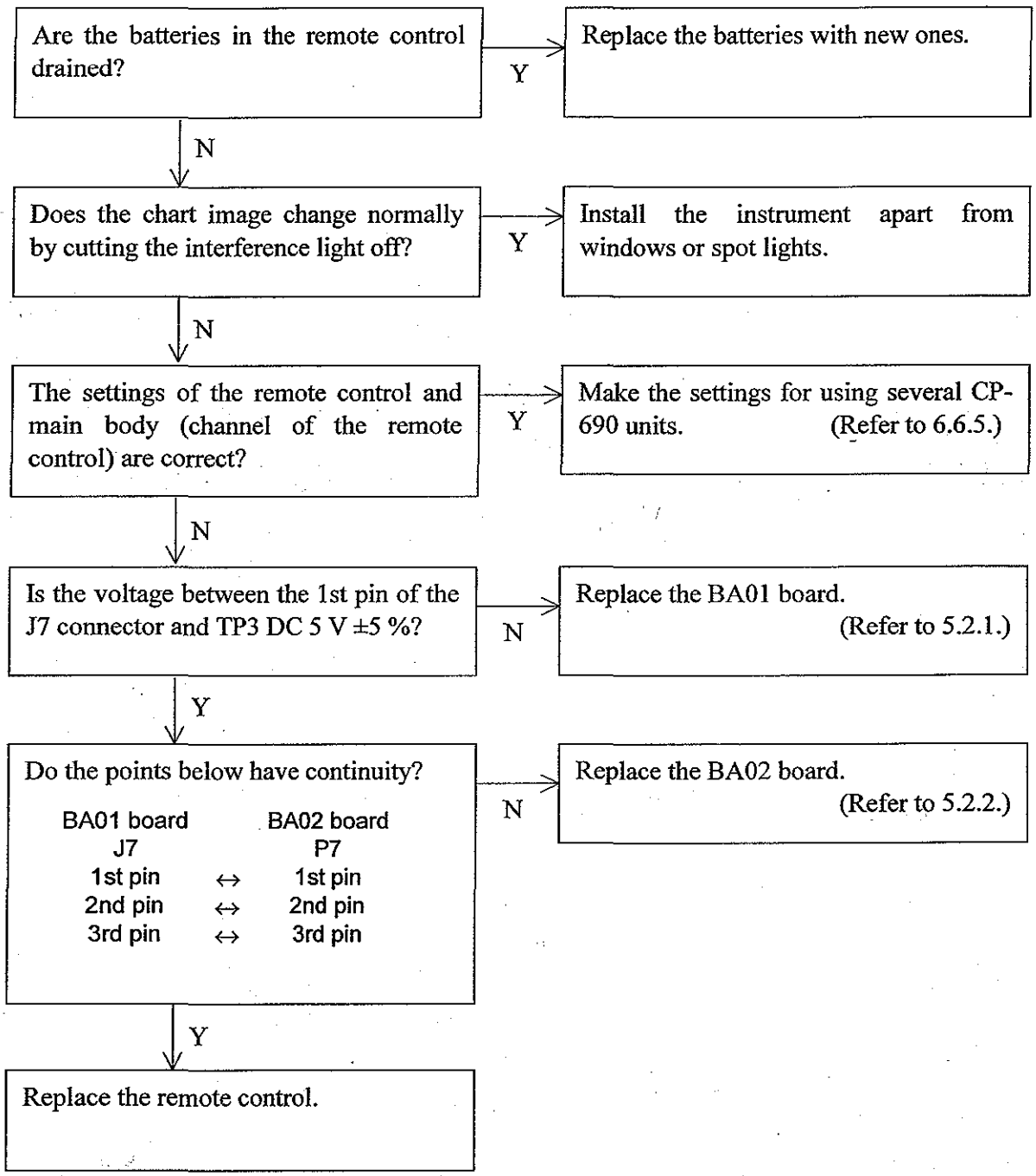
4.7 The Chart Brightness is Uneven.


Does the unevenness show up in the same area of the chart?
N
Clean the chart ASSY.
(Refer to 5.14.1.)
Y
Is the C lens ASSY dirty, burnt or scratched?
N
Clean the C lens ASSY.
(Refer to 5.14.2.)
If the dirt or burnt area can not be cleaned, or the ASSY is scratched, replace it. (Refer to 5.10.)
Y
Is the holder ASSY dirty, burnt or scratched?
N
Clean the holder ASSY.
(Refer to 5.14.3.)
If the dirt or burnt area can not be cleaned, or the ASSY is scratched, replace it. (Refer to 5.11.)
Y
Adjust the position of the lamp filament.
Is the chart brightness still uneven?
(Refer to 6.3.)
N
End
Y
Replace the screen.

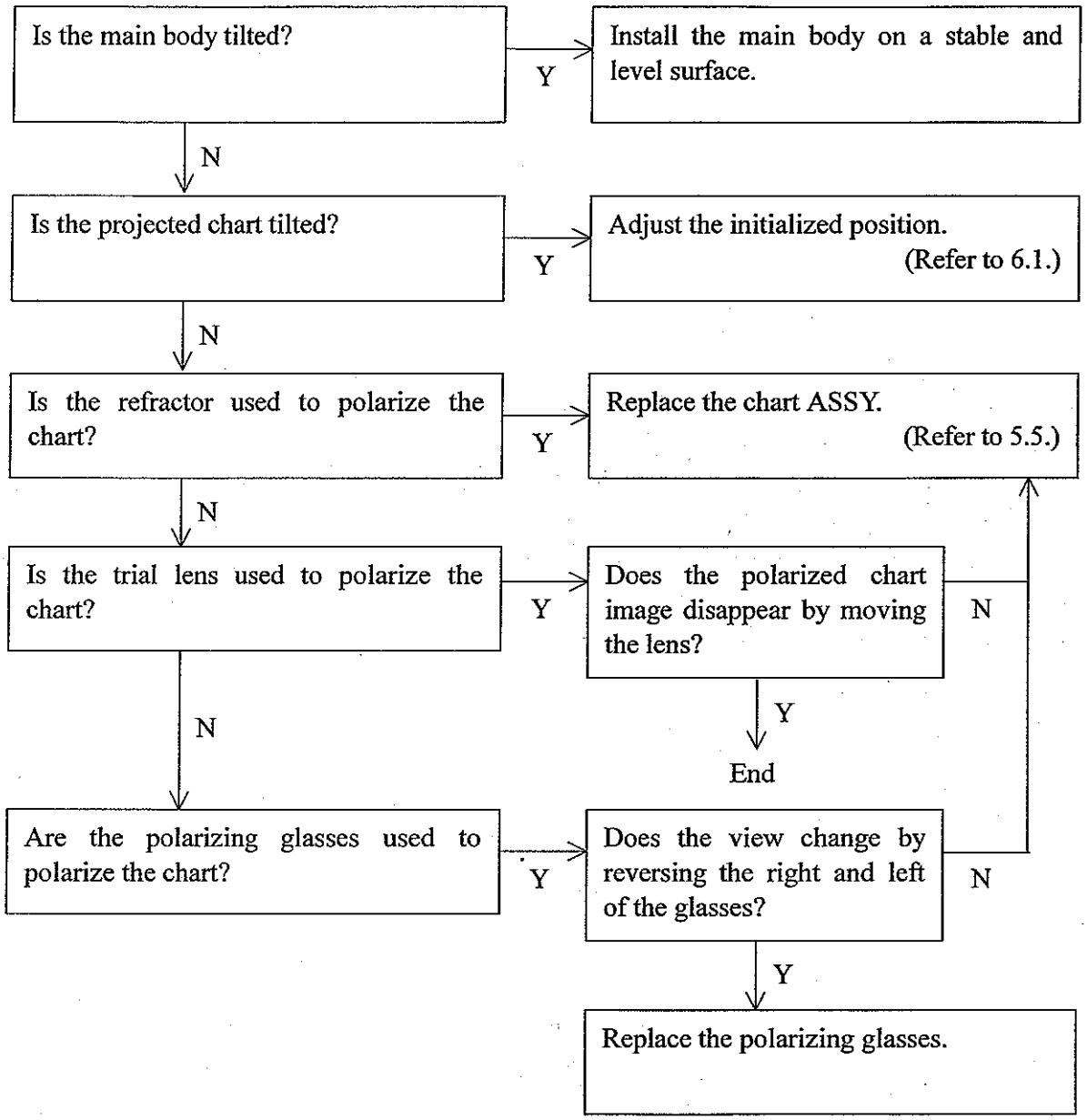
4.8 The Chart Image is not Clear.



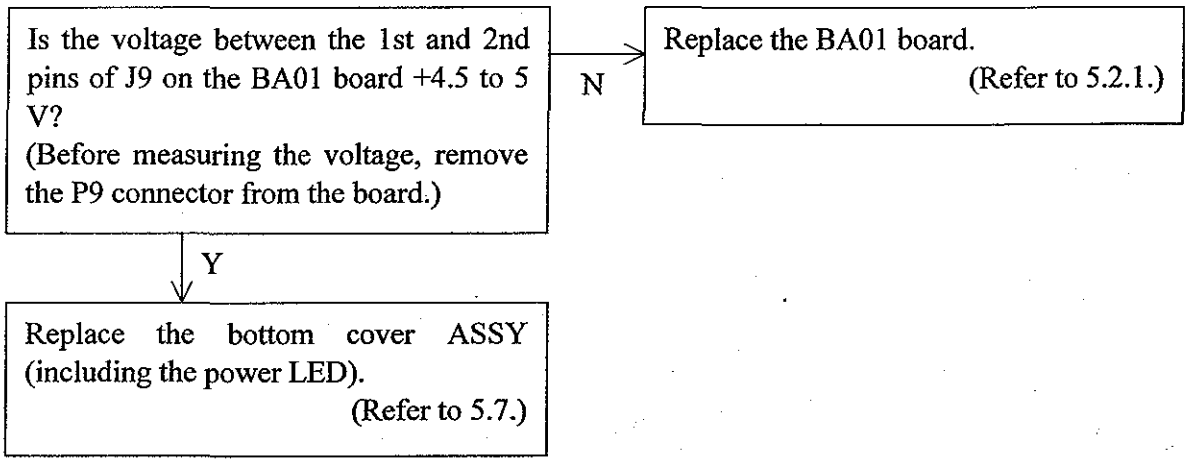
4.9 The Chart Image does not Change as Operated by the Remote Control.


Are the batteries in the remote control drained?
Y
Replace the batteries with new ones.
N
Does the chart image change normally by cutting the interference light off?
Y
Install the instrument apart from windows or spot lights.
N
The settings of the remote control and main body (channel of the remote control) are correct?
Y
Make the settings for using several CP-690 units. (Refer to 6.6.5.)
N
Is the voltage between the 1st pin of the J7 connector and TP3 DC 5 V ±5 %?
N
Replace the BA01 board. (Refer to 5.2.1.)
Y
Do the points below have continuity?
BA01 board J7
BA02 board P7
1st pin ↔ 1st pin
2nd pin ↔ 2nd pin
3rd pin ↔ 3rd pin
N
Replace the BA02 board. (Refer to 5.2.2.)
Y
Replace the remote control.

4.10 The Polarized Chart does not Disappear.



4.11 The LED does not Go On.


Is the voltage between the 1st and 2nd pins of J9 on the BA01 board +4.5 to 5 V?
(Before measuring the voltage, remove the P9 connector from the board.)
N
Replace the BA01 board.
(Refer to 5.2.1.)
Y
Replace the bottom cover ASSY (including the power LED).
(Refer to 5.7.)

§5 REPLACEMENT

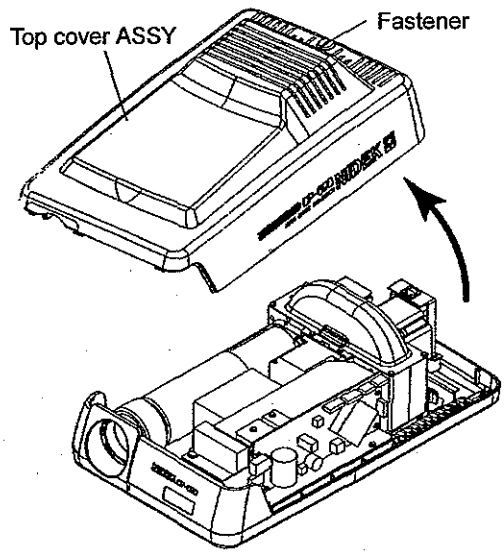
5.1 How to Remove the Covers

[NOTE] Before removing the covers, unless "Turn the power switch ON" is written, be sure to turn the power switch OFF and unplug the power cord.

[NOTE] Once the lamp goes on, its surroundings become hot. Do not touch parts near the lamp until they cool down.

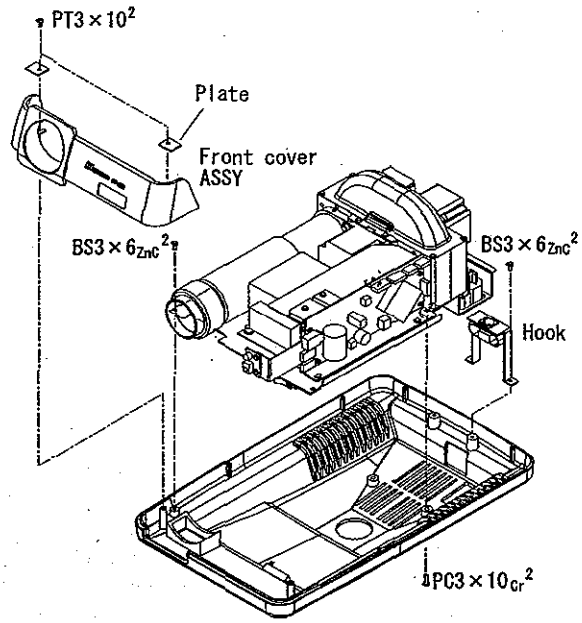
[How to remove the top cover ASSY]

Rotate the fastener a half-turn with a coin. Remove the top cover ASSY by lifting the rear side of it up.



[How to remove the front cover ASSY]

1. Remove the top cover ASSY.
2. Unscrew PT3 × 10^2 and remove the front cover ASSY together with the plate (M074).
   * When remounting this part, be careful of the orientation of the plate (M074). (See the right figure.)



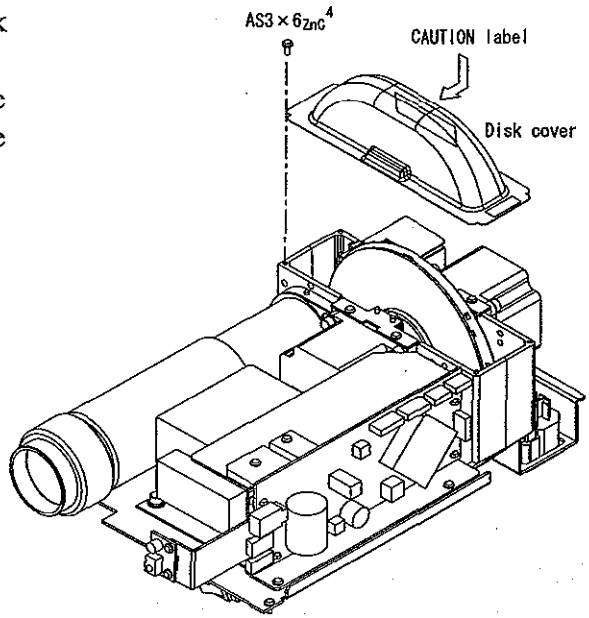
[How to remove the bottom cover ASSY]

1. Remove the top cover ASSY.
2. Disconnect the connector from J9 on the BA01 board.
3. Unscrew BS3 × $6_{ZnC}{}^2$ to remove the hook (M055).
4. Unscrew BS3 × $6_{ZnC}{}^2$ and PC3 × $10_{Cr}{}^2$ to remove the bottom cover.
   * When the lens barrel obstructs the removal, shorten it to the minimum.

[How to remove the disk cover]

1. Remove the top cover ASSY.

2. Unscrew AS3 × $6_{ZnC}{}^{4}$ to remove the disk cover (M030).
   * When remounting the disk cover, direct the side affixed with the CAUTION label to the lamp side (the rear side of the instrument).



5.2 Replacement of the Circuit Boards

5.2.1 Replacement of the BA01 board

Replacement part: BA01 board (33155-BA01)
* Circuit board, bridge diode, regulator IC, insulating sheet (Each 1 pc.)

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Remove all connectors from the BA01 board.**

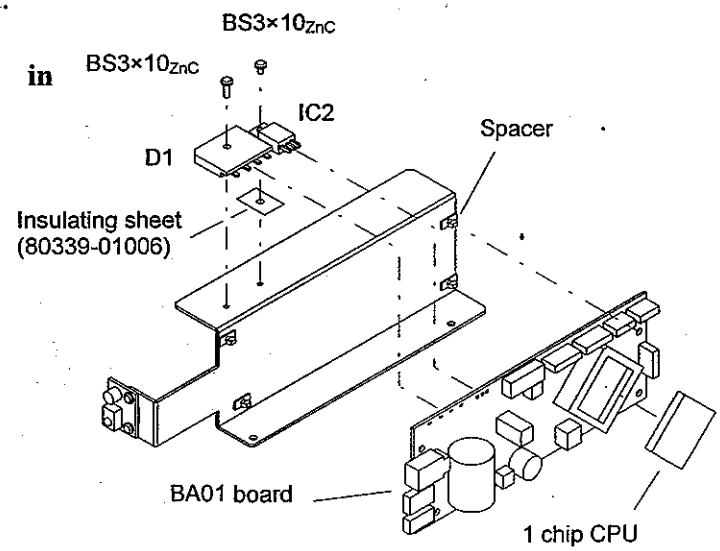
3. **Pull out 1 chip CPU from the BA01 board and install it into the new board.**
   [NOTE] Be careful of the orientation of the CPU.

4. **Unscrew BS3 × 10_{ZnC}^{2} fixing the bridge diode (D1) and regulator IC (IC2).**

5. **Remove the BA01 board while holding the tip of the four spacers with long nose pliers and then mount the new circuit board.**
   * Push the new board into the spacers securely.

6. **Fix the new bridge diode (D1) and regulator IC (IC2) into the radiator plate (M032) with the screws and then solder each terminal onto the BA01 board.**
   * When tightening the screws, catch the insulating sheet (80399-01006) between the regulator IC and radiator plate.
   * Do not catch the insulating sheet between the bridge diode and radiator plate. However, apply heat sink grease to the side contacting the cooling heat.
   * After soldering, cut the terminals protruding from the circuit board to a position of 2 to 4 mm from the board.
   * As the same with the last circuit board, adjust the position of VR1 (beep sound volume) and VR2 [light amount (voltage)] and set SW1 (DIP switch) and SW2 (light amount selecting switch) of the new board.

7. **Assemble the removed parts in reverse order.**



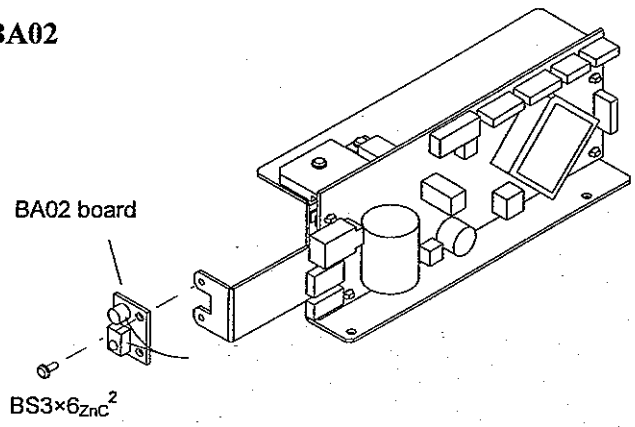
5.2.2 Replacement of the BA02 board

Replacement part: 33155-BA02

1. **Remove the top and front cover ASSYs. (Refer to 5.1.)**

2. **Disconnect the connector from J7 on the BA01 board.**

3. **Unscrew BS3 × $6_{ZnC}{}^{2}$ to replace the BA02 board with a new one.**



4. **Assemble the removed parts in reverse order.**

5.3 Replacement of the Sensors

5.3.1 Replacement of the chart sensor

Replacement part: Chart sensor (33155-EA05)

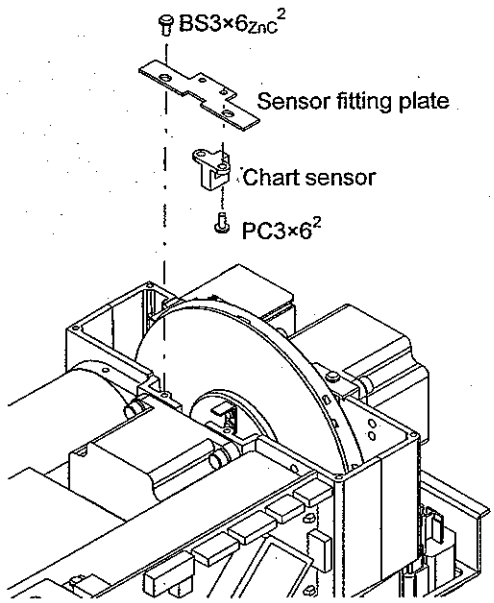
1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Disconnect the connector from J6 on the BA01 board.**
   * Cut the tie wrap (T18R) which ties the cables of the chart sensor.

3. **Remove the disk cover (M030). (Refer to 5.1.)**

4. **Unscrew BS3 × 6_{ZnC}^{2} to remove the chart sensor and sensor fitting plate (M009).**

5. **Unscrew PC3 × 6^{2} from the sensor fitting plate (M009) and replace the chart sensor (EA05) with a new one.**
   * Check that the shading plate of the mask disk does not interfere with the mask sensor.



6. **Assemble the removed parts (except for the top cover) in reverse order.**
   * Write the connector number "P6" on the connector of the replaced chart sensor with an oil-based ink (black).
   * Tie the wiring with the tie wrap (T18R) in its original position. (Refer to "7.2 How to carry out the wiring".)

7. **After performing "6.2 Adjustment of the sensor voltage", remount the top cover.**

5.3.2 Replacement of the mask sensor

Replacement part: Mask sensor (33155-EA05)

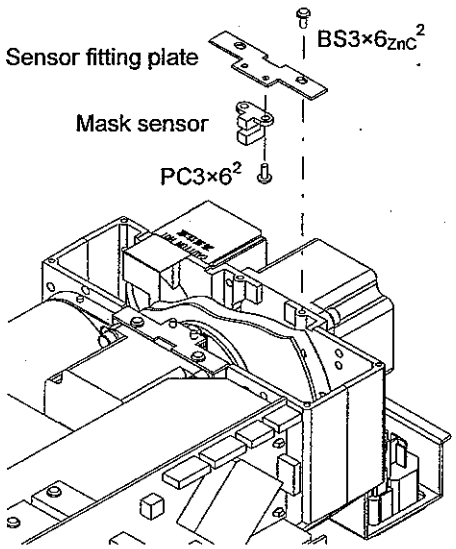
1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Disconnect the connector from J4 on the BA01 board.**
   * Cut the tie wrap (T18R) which ties the cables of the mask sensor.

3. **Remove the disk cover (M030). (Refer to 5.1.)**

4. **Unscrew BS3 × 6_{ZnC}^{2} to remove the mask sensor and sensor fitting plate (M009).**

5. **Unscrew PC3 × 6^{2} from the sensor fitting plate (M009) and replace the mask sensor (EA05) with a new one.**
   * Check that the shading plate of the mask disk does not interfere with the mask sensor.



6. **Assemble the removed parts (except for the top cover) in reverse order.**
   * Write down the connector number "P4" on the connector of the replaced mask sensor with an oil-based ink (black).
   * Tie the wiring with the tie wrap (T18R) in its original position. (Refer to "7.2 How to carry out the wiring".)

7. **After performing "6.2 Adjustment of the sensor voltage", remount the top cover.**

5.4 Replacement of the Chart Motor

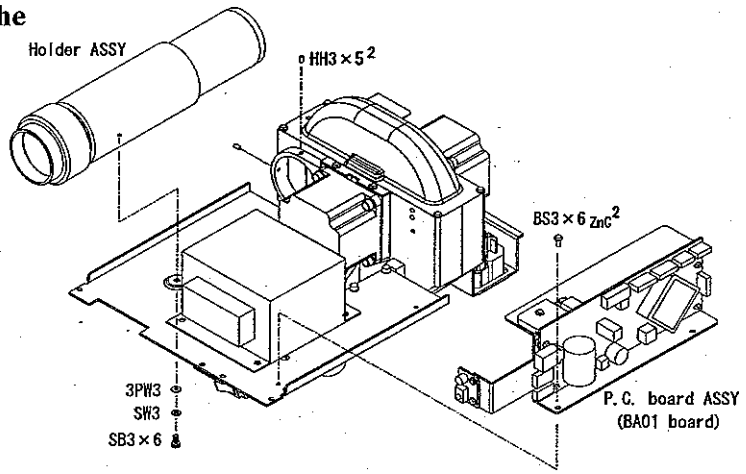
Replacement part: Chart motor (33155-E003)

1. **Remove the top and bottom cover ASSYs. (Refer to 5.1.)**

2. **Disconnect all connectors (except for J7) from the BA01 board.**
   * Cut the tie wrap (T18R) which ties the cables of the chart motor.

3 **Unscrew BS3 × 6_{ZnC}^{2} to remove the P.C. board ASSY (1500).**

4. **Loosen HH3 × 5^{2} and unscrew SB3 × 6, SW3 and 3PW3 to remove the holder ASSY (1300).**

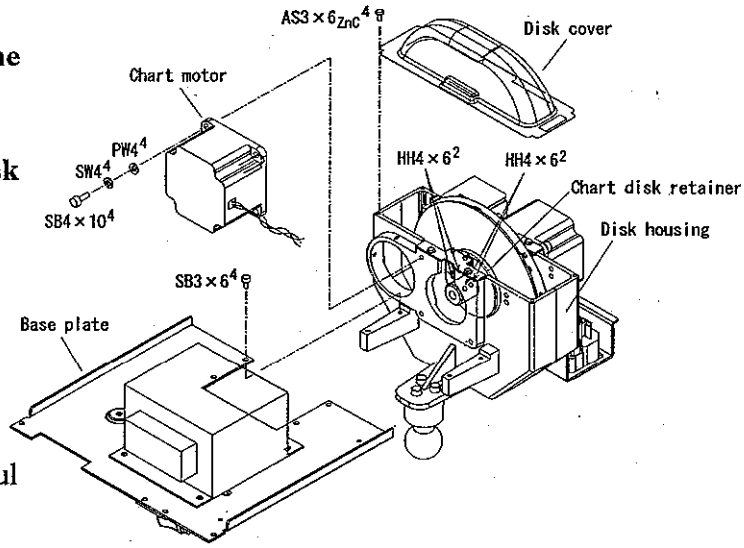


5. **Unscrew SB3 × 6^{4} to remove the base plate (M001).**

6. **Unscrew AS3 × 6_{ZnC}^{4} to remove the disk cover (M030).**

7. **Loosen HH4 × 6^{4} of the chart disk retainer.**

8. **Unscrew SB4 × 10^{4}, SW4^{4} and PW4^{4} and remove the chart motor to replace it with a new one.**
   * During this replacement, leave the chart ASSY in the disk housing.
   * Mount the chart motor being careful of the wiring side.



9. **Make a clearance of 0.5 mm between the mask and chart disks by displacing the chart ASSY. Tighten HH4 × 6[4] of the chart disk retainer.**
   * Tighten the four screws (HH4 × 6[4]) while checking that the two tips contact the notch of the motor shaft (flat side) vertically.
   * Check that the mask and chart disks do not contact each other by rotating them by hand. (As for the bottom of the disk housing, check the disks by shining light in there with a penlight.)

10. **Assemble the removed parts (except for the bottom and top cover ASSYs) in reverse order.**
   * Check that the shading plate of the chart disk does not interfere with the chart sensor.
   * Write down the connector number "P5" on the connector of the replaced mask sensor with an oil-based ink (black).
   * Tie the wiring with the tie wrap (T18R) in its original position. (Refer to "7.2 How to carry out the wiring".)

11. **After performing "6.1 Adjustment of the initialized position", "6.2 Adjustment of the sensor voltage" and "6.4 Adjustment the fixed mask position" and "6.5 Adjustment of the chart and mask positions", remount the bottom and top cover ASSYs.**

5.5 Replacement of the Chart ASSY

Replacement part: Chart ASSY (U type: 33156-1400, M type: 33156-3400, F type: 33157-1400, T type: 33158-1400, P type: 33159-1400, I type: 33160-1400, UK type: 33161-1400, A type: 33162-1400)

1. **Remove the top and bottom cover ASSYs. (Refer to 5.1.)**

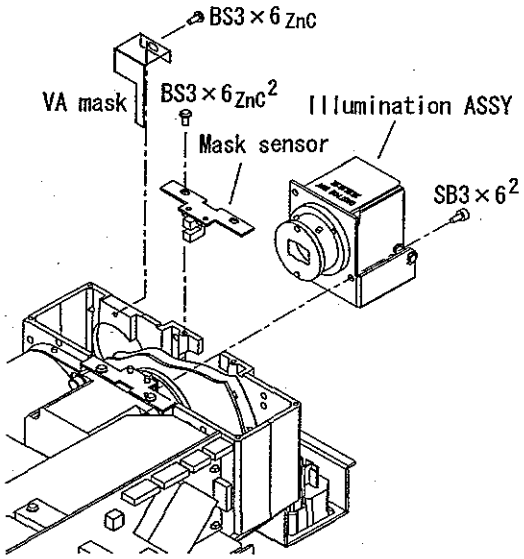
2. **Disconnect the connector from J3 on the BA01 board.**
   * Cut the tie wrap (T18R) which ties the cables of the mask motor.

3. **Remove the disk cover (M030). (Refer to 5.1.)**

4. **Unscrew BS3 × 6_{ZnC} to remove the VA mask (M029).**

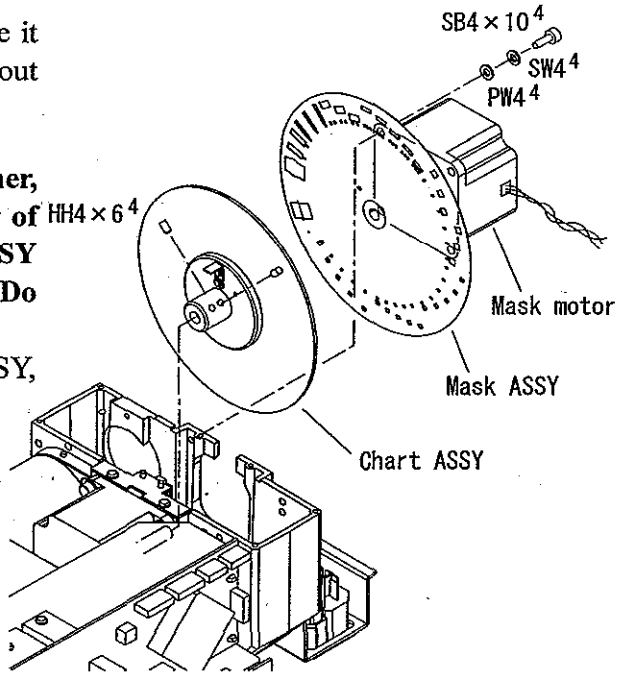
5. **Unscrew SB3 × 6^2 to remove the illumination ASSY (1200).**

6. **Unscrew BS3 × $6_{ZnC}{}^2$ to remove the mask sensor and sensor fitting plate (M009).**



7. **Unscrew SB4 × 10^4, SW4^4 and PW4^4 to remove the mask ASSY.**
   * In order to remove the mask ASSY, slide it to the rear side slightly and pull it out upward.

8. **Loosen HH4 × 6^4 of the chart disk retainer, pull out the chart ASSY from the shaft of the chart motor by sliding the chart ASSY and then insert the new chart ASSY. (Do not tighten HH4 × 6.)**
   * Before mounting the new chart ASSY, check that it has no dirt such as dust.



9. **Make a clearance of 0.5 mm between the mask and chart disks by displacing the chart ASSY. Tighten HH4 × 6^4 of the chart disk retainer.**
   * Tighten the four screws (HH4 × 6^4) while checking that the two tips contact the notch of the motor shaft (flat side) vertically.
   * Check that the mask and chart disks do not contact each other by rotating them by hand. (As for the bottom of the disk housing, check the disks by shining light in there with a penlight.)

10. **Assemble the removed parts (except for the bottom and top cover ASSYs) in reverse order.**
    * Check that the shading plate of the mask disk does not interfere with the mask sensor after remounting the mask sensor.
    * Tie the wiring with the tie wrap (T18R) in its original position. (Refer to "7.2 How to carry out the wiring".)
    * Remount the VA mask (M029) toward the inside of the instrument (mask motor side). (Refer to "6.6.2. To display or not display the visual acuity".)

11. **After performing "6.1 Adjustment of the initialized position", "6.2 Adjustment of the sensor voltage" and "6.4 Adjustment the fixed mask position" and "6.5 Adjustment of the chart and mask positions", remount the bottom and top cover ASSYs.**

5.6 Replacement of the Mask Motor and Mask ASSY

Replacement part: Mask motor (33155-E003), mask ASSY (U, M, F, T and P types: 33156-1100, I type: 33160-1100, UK and A types: 33161-1100)

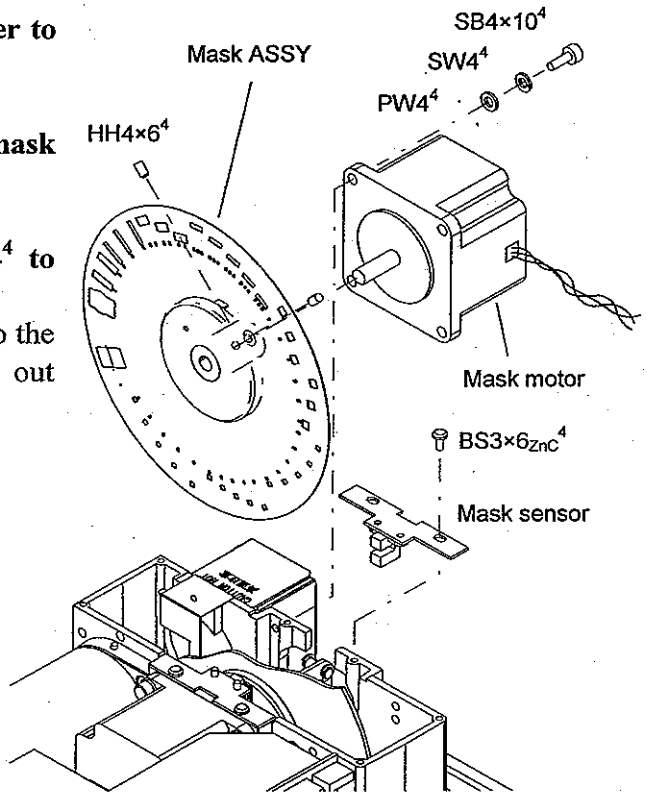
1. **Remove the top and bottom cover ASSYs. (Refer to 5.1.)**

2. **Disconnect the connector from J3 on the BA01 board. Cut the tie wrap (T18R) tying the cables of the mask motor.**

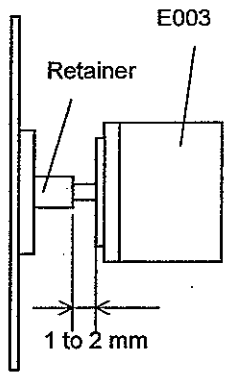
3 **Remove the disk cover (M030). (Refer to 5.1.)**

4. **Unscrew BS3 × $6_{ZnC}{}^2$ to remove the mask sensor and sensor fitting plate (M009),**

5. **Unscrew SB4 × 10^4, SW4^4 and PW4^4 to remove the mask ASSY.**
   * Remove the mask ASSY by sliding it to the rear side slightly and then pull it out upward.



6. **Loosen HH4 × 6^4 of the mask disk retainer to replace the mask motor (E003) or mask ASSY with a new one.**
   * The two tips among HH4 × 6^4 shall contact the notch of the motor shaft (flat side) vertically.
   * Fix the exposed part of the motor shaft to <u>about 1 to 2 mm</u> with HH4 × 6^4 temporarily.



7. **Fix the mask ASSY in the disk housing.**
   * Mount the disk motor being careful of the wiring side. (Refer to the figure on page 5-11.)

8. **Loosen HH4 × 6^4 of the mask disk retainer to make a clearance of 0.5 mm between the mask and chart disks. Retighten HH4 × 6^4.**
   * Tighten the four screws (HH4 × 6^4) while checking that the two tips contact the notch of the motor shaft (flat side) vertically.
   * Check that the mask and chart disks do not contact each other by rotating them by hand. (As for the bottom of the disk housing, check the disks by shining light in there with a penlight.)

9. **Assemble the removed parts (except for the bottom and top cover ASSYs) in reverse order.**
   * Check that the shading plate of the mask disk does not interfere with the mask sensor.
   * Write down the connector number "P3" on the connector of the replaced mask sensor with an oil-based ink (black).
   * Tie the wiring with the tie wrap (T18R) in its original position. (Refer to "7.2 How to carry out the wiring".)

10. **After performing "6.1 Adjustment of the initialized position", "6.2 Adjustment of the sensor voltage" and "6.5 Adjustment of the chart and mask positions", remount the bottom and top cover ASSYs.**

5.7 Replacement of the Bottom Cover ASSY (Power LED)

Replacement part: Bottom cover ASSY (33156-1010)

1. **After removing the top and front cover ASSYs according to "5.1 How to remove the covers", replace the bottom cover ASSY with a new one. (Refer to 5.1.)**
   * Peel off the fuse label (100V system: 33102-M103, 200V system: 33138-M086), serial number label and serial number plate from the bottom ASSY and stick them to the new bottom cover ASSY in the same positions. (The A type does not have the serial number label.)

2. **Assemble the removed parts in reverse order.**

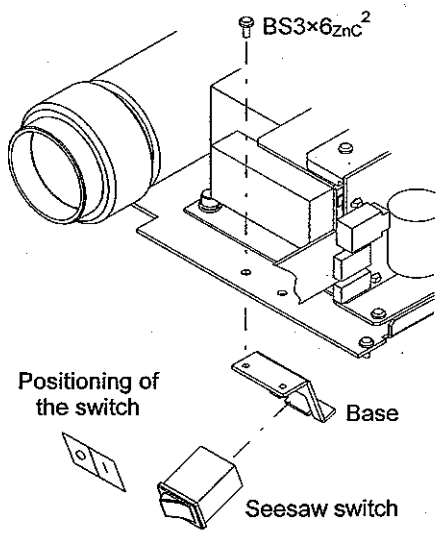
5.8 Replacement of the Power Switch

Replacement part: Seesaw switch (80460-00103)

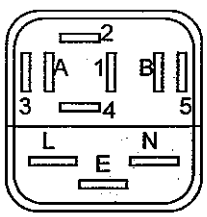
1. **Remove the top and bottom cover ASSYs. (Refer to 5.1.)**

2. **Unscrew BS3 × 6_{ZnC}^{2} to remove the base (M033).**

3. **Remove the hook part of the seesaw switch from the base (M033).**



4. **Disconnect the black and white wires (each: 2) from the removed seesaw switch and then connect these wires to the new seesaw switch.**



Terminal position of the inlet

Black wire of the inlet terminal A → Terminal 1 of the switch part
White wire of the inlet terminal B → Terminal 2 of the switch part
Black wire of the inlet terminal L → Terminal 1a of the switch part
White wire of the inlet terminal N → Terminal 2a of the switch part

5. **Assemble the removed parts in reverse order.**
   * Be careful of the positioning of the seesaw switch.

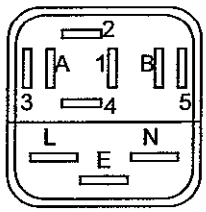
5.9 Replacement of the Power Transformer

Replacement part: Power transformer (100 V system: 33155-E001, 200 V system: 33155-E002)

1. **Remove the top and bottom cover ASSYs. (Refer to 5.1.)**

2. **Disconnect the connector from J1 on the BA01 board.**

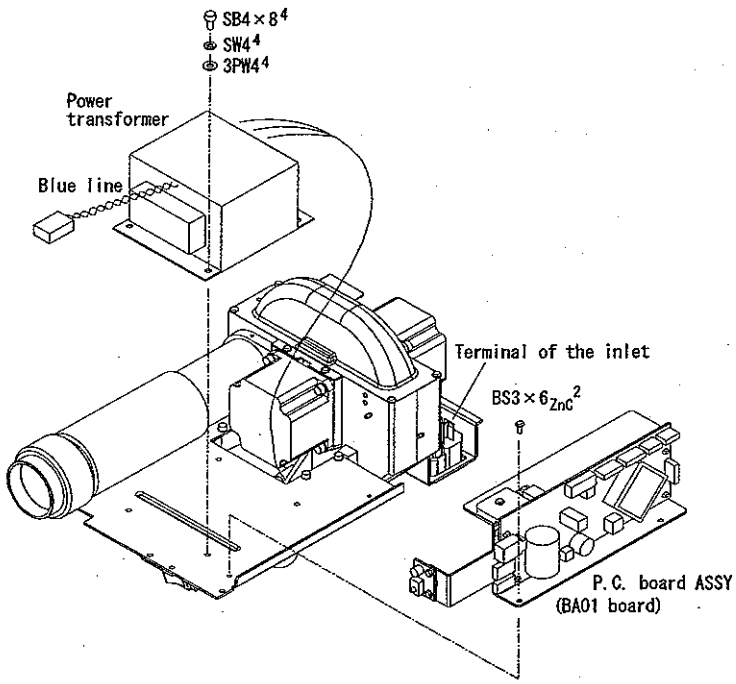
3. **Disconnect the wires from the terminals (1, 2 and 5) of the inlet.**
   * Cut the tie wrap (T18R) which ties the wires.



Terminal position of the inlet

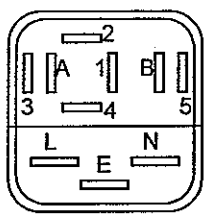
4. **Unscrew BS3 × $6_{ZnC}{}^2$ to displace the board ASSY (1500) until the screws fixing the transformer appear.**

5. **Unscrew SB4 × 8^4, SW4^4 and 3PW4^4 to replace the transformer with a new one.**



6. **Draw the wires (black, brown and red) of the new transformer through the clearance between the base plate (M001) and chart motor. Connect the wires to the following terminals of the inlet.**

[Wiring of the 100 V system power transformer]
Black wire of the transformer → Terminal 5 of the inlet
Brown wire of the transformer → Terminal 1 of the inlet
Red wire of the transformer → Terminal 2 of the inlet
[Wiring of the 200 V system power transformer]
Black wire of the transformer → Terminal 5 of the inlet
Orange wire of the transformer → Terminal 4 of the inlet



Terminal position of the inlet

* Retie the wiring in the original position with the tie wrap (T18R).

7. **Assemble the removed parts in reverse order.**

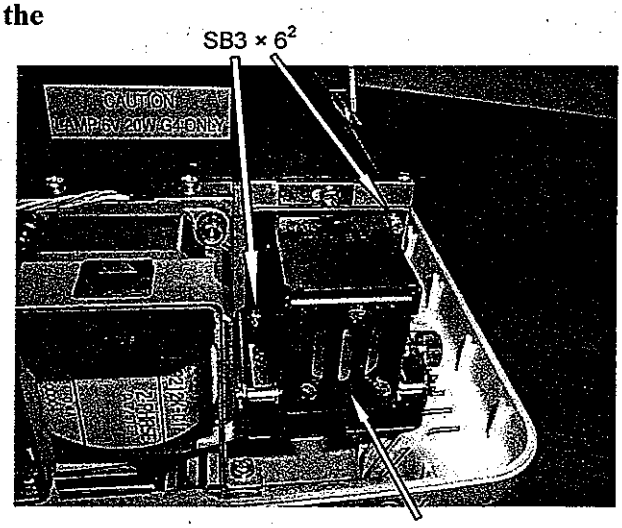
5.10 Replacement of the C lens ASSY, Lamp Cable and Reflecting Mirror

Replacement parts: C lens ASSY (U, M, F, T, P and I types: 33156-1210, UK and A types: 33161-1210), lamp cable (33155-EA04), reflecting mirror (33156-G002)

[NOTE] Once the lamp goes on, its surroundings become hot. Do not touch parts near the lamp until they cool down.

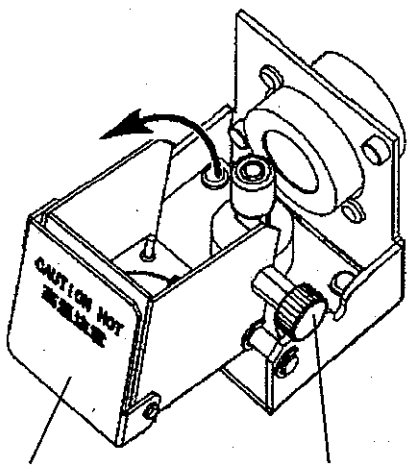
1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Unscrew SB3 × 6^2 to remove the illumination ASSY (1200).**



Illumination ASSY

3. **Loosen the screw fixing the lamp cover to open the lamp cover.**



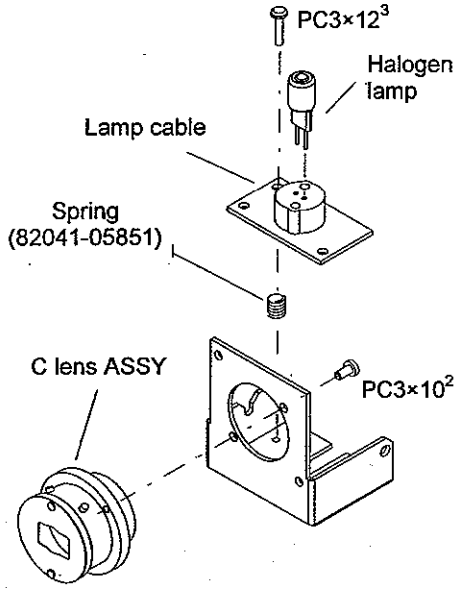
Lamp cover

Screw fixing the lamp cover

[Replacement of the C lens ASSY]

1) Unscrew PC3 × 10^2 to replace the C lens ASSY (1210).

* Mount the C lens ASSY so that the 2 screws are facing up.



[Replacement of the lamp cable]

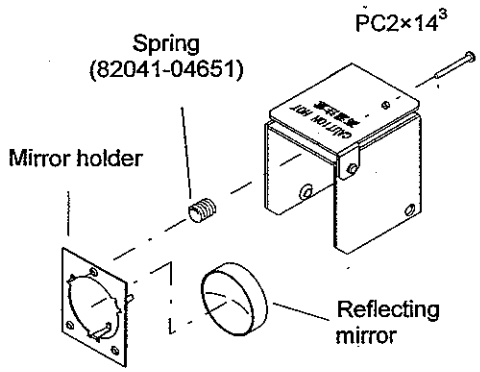
1) Pull out the halogen lamp.
   * Do not touch the halogen lamp directly. Hold it with tissue paper etc.
2) Disconnect the connector from J2 of the BA01 board.
3) Unscrew PC3 × 12^3 to replace the lamp cable (EA04).
   * Pay attension not to lose the spring (82041-05851).
   * Cut the tie wrap (T18R) tying the lamp cable (EA04). After replacing, retie it in the original position.
4) Insert the halogen lamp into the original position securely.

[Replacement of the reflecting mirror]

1) Unscrew PC2 × 14^3 to remove the mirror holder (M020) and reflecting mirror.
2) Bend the three tabs of the mirror holder (M020) to replace the mirror with a new one.

* Pay attension not to lose the spring (82041-04651).

* When bending the tabs, do not strain the reflecting mirror. If not, the edge of the mirror may be chipped.



4. **Close the lamp cover securely and tighten the screw fixing the lamp cover.**
   * Tighten the screw with a flatblade screwdriver.

5. **Assemble the removed parts (except for bottom and top cover ASSYs) in reverse order.**

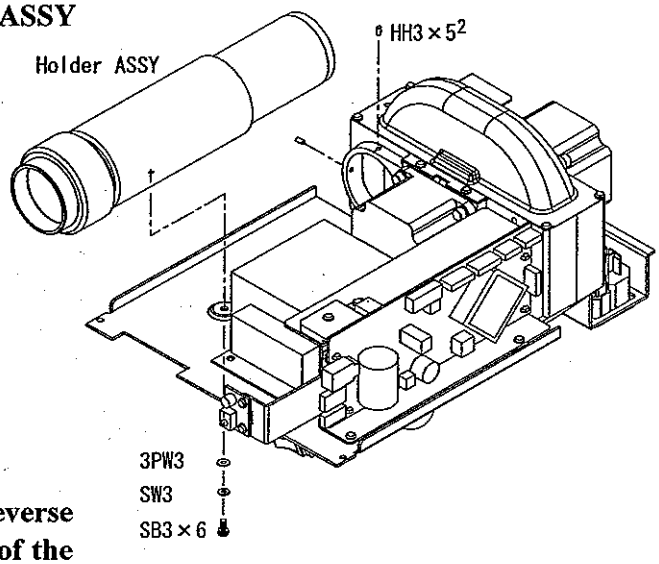
6. **After performing "6.4 Adjustment of the fixed mask position" and "6.3 Adjustment of the lamp filament position", remount the bottom and top cover ASSYs.**

5.11 Replacement of the Holder ASSY

Replacement part: Holder ASSY (U, M, F, T, P and I types: 33138-1300, UK and A types: 33362-M4604)

1. **Remove the top and bottom cover ASSYs. (Refer to 5.1.)**

2. **Loosen HH3 × 5^2 to remove SB3 × 6, SW3 and 3PW3 and replace the holder ASSY with a new one.**



3. **Assemble the removed parts in reverse order. Adjust the installed position of the main body and the focus according to the operator's manual.**

5.12 Replacement of the Halogen Lamp

Replacement part: Halogen lamp (80426-00069)

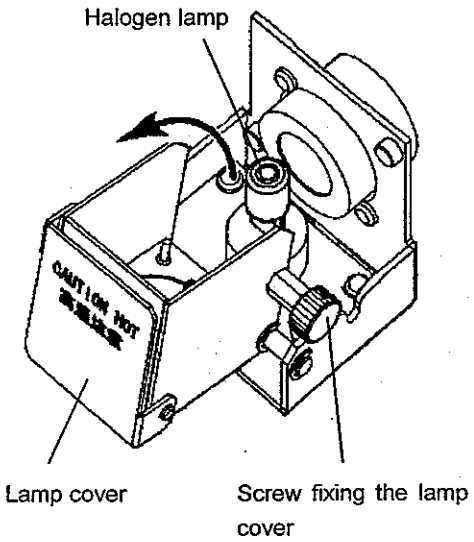
[NOTE] Once the lamp goes on, its surroundings become hot. Do not touch parts near the lamp until they cool down.

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Loosen the screw fixing the lamp cover to open the lamp cover.**

3. **Pull out the halogen lamp and insert the new halogen lamp into the socket.**
   * Do not touch the halogen lamp directly. Hold it with tissue paper etc.
   * Check that the halogen lamp is inserted securely.

4. **Close the lamp cover securely and tighten the screw fixing the lamp cover.**
   * Tighten the screw with a flatblade screwdriver.



5. **After performing "6.3 Adjustment of the lamp filament position", remount the top cover ASSY.**

5.13 Replacement of the Fuses

Replacement parts: Two fuses [100 V system: 80402-02039 (1 A, 250 V), 200 V system: 80402-02037 (0.5 A, 250 V)]

Replace the fuses according to the operator's manual.

5.14 Cleaning

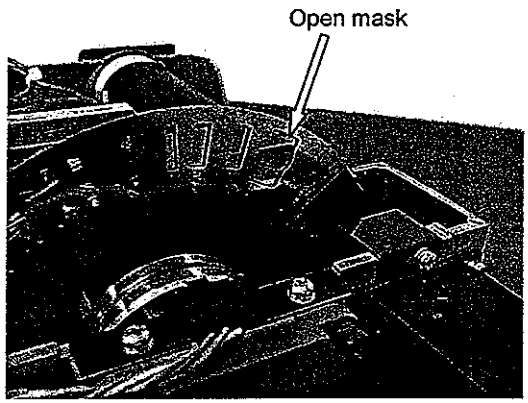
5.14.1 Cleaning of the chart and mask

1. **Remove the top cover ASSY and disk cover (M030). (Refer to 5.1.)**

2. **Blow off the dust on the disks with a blower.**

   * For stubborn dirt on the disks, wipe it with a swab whose tip is wrapped in lens cleaning paper and is dampened with the liquid mixture.

   * When cleaning the opposite sides of the chart and mask disks, rotate both disks by hand and wipe the chart disk through the open mask. [If it is impossible, remove the chart or mask ASSY (Refer to 5.5, 5.6) to wipe the disks.]



   * Wipe the disks so as not to leave wipe marks.

   * When wiping the mask disk, pay attention not to leave lint on the disk.

   * When cleaning the filter bond with the chart, wipe only its surface lightly. Do not touch the adhesive.

3. **Assemble the removed parts in reverse order.**

5.14.2 Cleaning of the halogen lamp, reflecting mirror and condenser lens

[NOTE] Once the lamp goes on, its surroundings become hot. Do not touch parts near the lamp until they cool down.

1. **Remove the top cover ASSY. (Refer to 5.1.)**

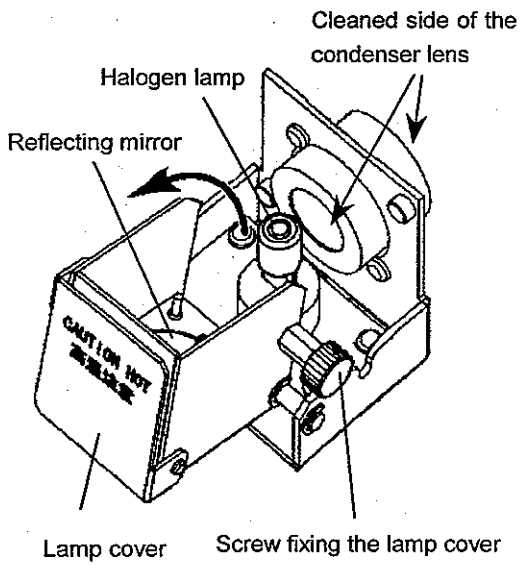
2. **Loosen the screw fixing the lamp cover to open the lamp cover.**

3. **[Cleaning of the halogen lamp]**
   Wipe the dirt on the lamp with a dry cloth. At this time, do not pull out the lamp from the socket and change the position and angle of the lamp.
   If the lamp position is changed or the lamp is removed, perform "6.3 Adjustment of the lamp filament position".

   * Pay attention not to touch the surface of the lamp directly.

   [Cleaning of the reflecting mirror and condenser lens]
   Blow the dust off with a blower.
   For stubborn dirt, wipe it with a swab whose tip is wrapped in lens cleaning paper and is dampened with the liquid mixture.

   * Wipe them so as not to leave wipe marks.

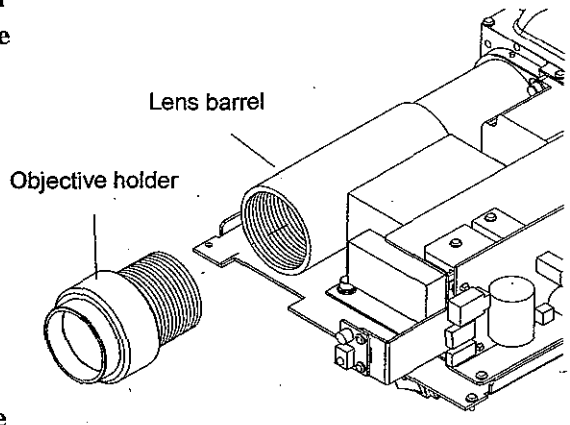


4. **Close the lamp cover and remount the top cover ASSY.**
   * Close the lamp cover securely and tighten the screw fixing the lamp cover with a flatblade screwdriver.

5.14.3 Cleaning of the holder ASSY

1. **Remove the top and front cover ASSYs. (Refer to 5.1.)**

2. **Rotate the objective holder counterclockwise to remove it from the lens barrel.**



3. **Clean the surface of the lens of the objective holder.**

   * Blow the dust off with a blower. For stubborn dirt, wipe it with a swab whose tip is wrapped in lens cleaning paper and is dampened with the liquid mixture.
   * Wipe them so as not to leave wipe marks.

4. **After assembling the removed parts in reverse order, perform the adjustment of the installed position of the main body and the focus according to the operator's manual.**

6.1 Adjustment of the Initialized Position

The sensors and shading plates detect the initialized position.
The sensor voltage (position) must be adjusted when the motor, sensors and disks are misaligned by replacing or adjusting the parts.

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Turn No. 8 of the DIP switch on the BA01 board to the ON position and turn the power switch ON.**
   * Install the main body on a stable and level surface.
   * When turning the DIP switch to the ON or OFF position, slide the switch without loading the circuit board. If not, a failure may occur.

3. **Project the chart on the screen and roughly adjust the focus.**

4. **Operate the remote control as follows so that the first projected chart and open mask become horizontal.**
   VA UP button ····· Move the chart up
   VA DOWN button ····· Move the chart down
   START button ····· Move the mask up
   NEXT button ····· Move the mask down

5. **After checking that the chart is not blocked, press the R/G button. (The initialized position is memorized.)**

6. **Turn No. 8 of the DIP switch to the OFF position, remount the top cover ASSY and then turn the power switch OFF and ON.**

6.2 Adjustment of the Sensor Voltage

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Turn No. 8 of the DIP switch on the BA01 board to the ON position and turn the power switch ON.**
   * When turning the DIP switch to the ON or OFF position, slide the switch without loading the circuit board. If not, a failure may occur.

3. **Adjust the voltage of the chart and mask sensors as follows.**

[Voltage adjustment of the chart sensor]

1) Measure the voltage between **TP1** and **TP3** on the BA01 board. Check that this voltage is within the applicable range as follows. If it is not, make the voltage within the applicable range by displacing the chart sensor.
   [Applicable range: 4.5 V to 5.0 V]
2) Press the **VA DOWN botton** on the remote control twice and the **VA UP button** once.
3) Measure the voltage between **TP1** and **TP3** on the BA01 board. Check that this voltage is within the applicable range as follows. If it is not, make the voltage within the applicable range by displacing the chart sensor.
   [Applicable range: 0.5 V or less]
4) Press the **VA UP button** on the remote control once. Check that the voltage between **TP1** and **TP3** is **4.5 V to 5.0 V.**

[Voltage adjustment of the mask sensor]

1) Measure the voltage between **TP2** and **TP3** on the BA01 board. Check that this voltage is within the applicable range as follows. If it is not, make the voltage within the applicable range by displacing the mask sensor.
   [Applicable range: 4.5 V to 5.0 V]
2) Press the **START botton** on the remote control twice and the **NEXT button** once.
3) Measure the voltage between **TP2** and **TP3** on the BA01 board. Check that this voltage is within the applicable range as follows. If it is not, make the voltage within the applicable range by displacing the chart sensor.
   [Applicable range: 0.5 V or less]
4) Press the **NEXT button** on the remote control once. Check that the voltage between **TP2** and **TP3** is **4.5 V to 5.0 V.**

Guide: When the voltage is higher than the applicable range, bring the sensor close to the shading plate. When it is lower, locate the shading plate away from the sensor.

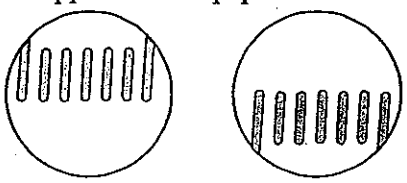
4. **Turn No. 8 of the DIP switch to the OFF position, remount the top cover ASSY and then turn the power switch OFF and ON.**

6.3 Adjustment of the Lamp Filament Position

* Before adjustment, check that the lamp cover is closed securely. Tighten the screw fixing the lamp cover.

[NOTE] The parts around the lamp become hot. Do not touch the parts directly by hand.

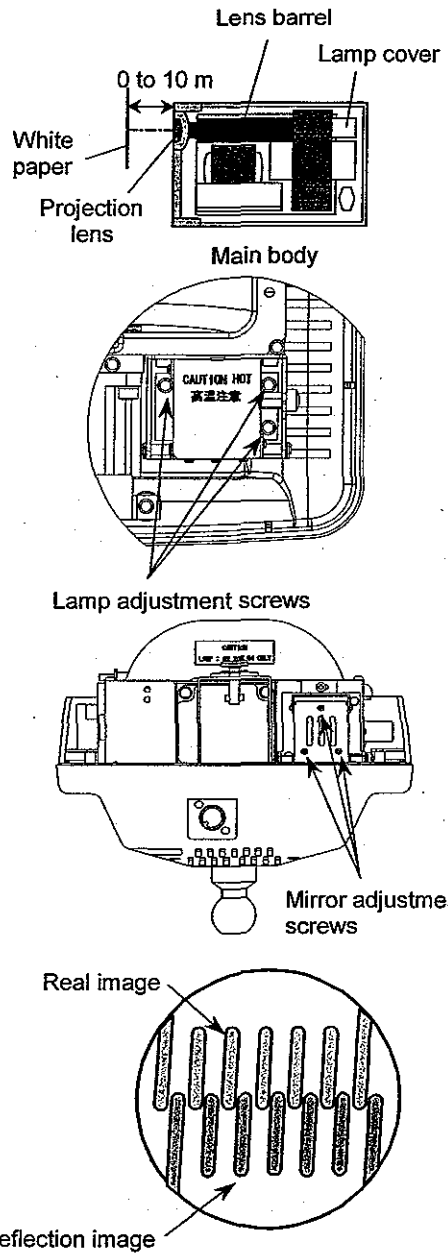
1. **Remove the top cover ASSY (refer to 5.1) and turn the power switch ON. Place a piece of white paper at a position of 0 to 10 mm from the lower side of the front cover.**
   * The true and reflection images of the lamp filament appear on the paper as follows.



Real image Reflection image

2. **Adjust the focus of the real image of the lamp filament by pushing and pulling the lamp adjustment screws (n = 3) as shown in the right figure. (See the figure of the real image above.)**
   * When the filament image is unclear, move the paper back and forth.

3. **Move the reflection image of the lamp filament by pushing and pulling the mirror adjustment screws (n = 3) as shown in the right figure so that the true and reflection images overlap partly.**
   * At this time, check that the reflection image is focused.



4. **Project the chart onto the screen to check that the chart brightness is even. If it is even, apply a threadlocking adhesive to the top of the lamp and mirror adjustment screws.**

5. **Remount the top cover ASSY.**

6.4 Adjustment of the Fixed Mask Position

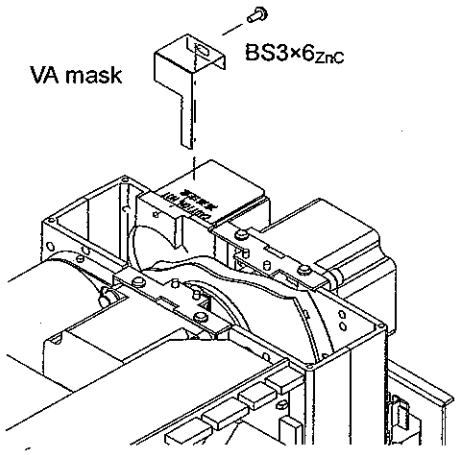
[NOTE] The parts around the lamp become hot. Do not touch the parts directly by hand.

1. **Turn the power switch ON, project the chart on the screen and adjust the focus.**

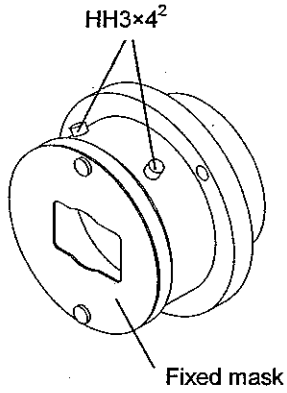
2. **Turn the power switch OFF, remove the top cover ASSY and disk cover (M030). (Refer to 5.1.)**

3. **Disconnect the connectors from J3 and J5 on the BA01 board.**

4. **Unscrew BS3 × 6_{ZnC} to remove the VA mask (M029).**



5. **Turn the power switch ON again, rotate the chart and mask disks by hand to check the position (tilt) of the fixed mask.**
   * The fixed mask resembles the open mask of the mask disk in shape.
   * When checking the position, adjust the focus to the chart. (The fixed mask appears such as a fuzzy image.)



6. **Loosen HH3 × 4^2 to rotate the fixed mask by hand. Adjust it to satisfy the following conditions.**
   - The fixed mask shall be horizontal against the chart.
   - When overlapping the chart with the fixed mask horizontally, the fixed mask shall not hide part of the chart. (Perform the same check on the astigmatism clock dial and dots charts.)

7. **Tighten the loosened screws while pushing the fixed mask into the lamp side.**
   * After tightening the screws, check the position of the fixed mask again.

8. **Assemble the removed parts in reverse order.**
   * Remount the VA mask (M029) toward the inside of the instrument (mask motor side).

6.5 Adjustment of the Chart and Mask Positions

1. **Remove the top and bottom cover ASSYs and disk cover (M030). (Refer to 5.1.)**

2. **Turn the power switch ON, project the chart onto the screen and adjust the focus.**

3. **Loosen SB4 × 10^4, SW4^4 and PW4^4 fixing the mask motor. Make fine adjustments of the mask motor position to satisfy the following conditions.**
   * If the adjustment can not be completed by moving the mask motor, move the chart position by making fine adjustments of the chart sensor position. However, when the chart sensor is moved, perform "6.4 Adjustment of the fixed mask position".

   • Single letter mask position
   When applying the single letter mask to the following charts [the parenthesized numbers are visual acuity], the alphabetical letter shall be in about the center of the mask.
   U type: Alphabet (70), M type: Alphabet (100), F type: Alphabet (0.3), T type: Alphabet (0.2), P type: Alphabet (0.2), I type: Number (0.25), UK type: Alphabet (24), A type: Hiragana (0.3)

   • R/G filter position
   The boundary between the red and green filters shall be in the middle of the chart horizontally. As a guide, the boundary is within about 3 mm from the center at the refractive distance of 5 m.

   • Blocking of the astigmatism clock dial chart
   The projected astigmatism clock dial chart shall be not blocked.

   • Positions of the horizontal and vertical line masks
   When applying the horizontal or vertical line mask to the following charts [the parenthesized numbers are visual acuity], the mask shall not incline and the next chart shall not be seen (for checking the light leakage).
   U type: Alphabet (70 to 50), M type: Alphabet (100 to 20), F type: Alphabet (0.3 to 0.5), T type: Alphabet (0.2 to 0.4), P type: Alphabet (0.2 to 0.32), I type: Number (0.25 to 0.4), UK type: Alphabet (24 to 15), A type: Hiragana (0.2 to 0.4)

4. **Tighten the loosened screws and check to satisfy the above conditions.**

5. **Perform "6.1 Adjustment of the initialized position" and "6.2 Adjustment of the sensor voltage".**

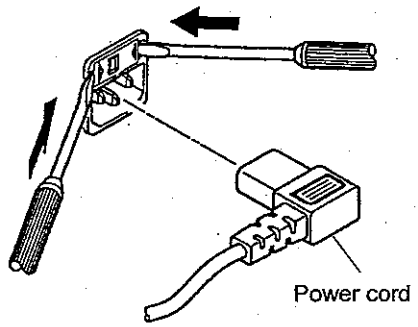
6.6 Setting

6.6.1 Setting of the voltage selector

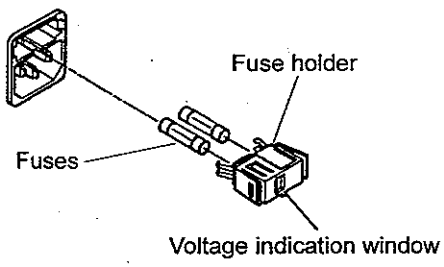
* Check that the number indicated in the voltage indication window, which is next to the power socket on the bottom side of the instrument, matches the supplied power voltage. If not, change it as follows.

1. **Turn the power switch OFF and disconnect the power cord from the main body.**

2. **Pull the fuse holder out while pushing both sides of the fuse holder with thin flatblade screwdrivers to release the fixing lips.**



3. **Remove the voltage selector together with the fuses, change the orientation of the voltage selector so that the applicable voltage is indicated and reinsert it.**

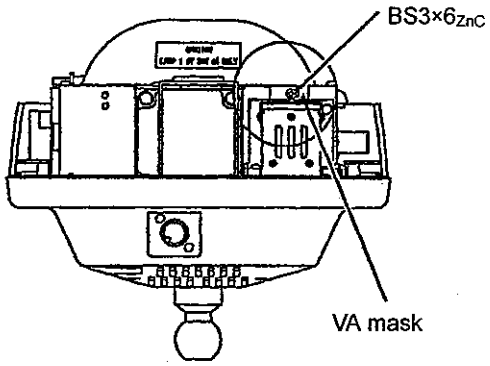


4. **Fit the fuse holder into the original position.**

6.6.2 To display or not display the visual acuity

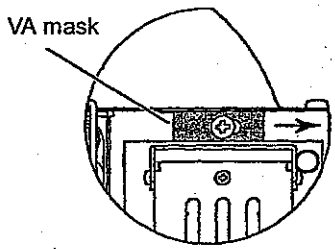
1. **Remove the top cover ASSY. (Refer to 5.1.)**

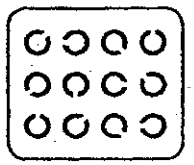
2. **<u>Loosen</u> BS3 × 6_{ZnC} fixing the VA mask.**



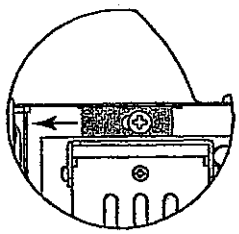
3. **Switch between the display and non-display of the visual acuity by moving the VA mask.**

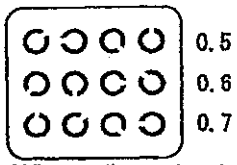
[In order not to display the visual acuity]
Move the VA mask (M029) toward the outside of the instrument (right side). Tighten the loosened BS3 × 6_{ZnC} temporally.




When the visual acuity is not displayed.

[In order to display the visual acuity]
Move the VA mask (M029) toward the inside of the instrument (left side: mask motor side). Tighten the loosened BS3 × 6_{ZnC} temporally.





When the visual acuity is displayed.

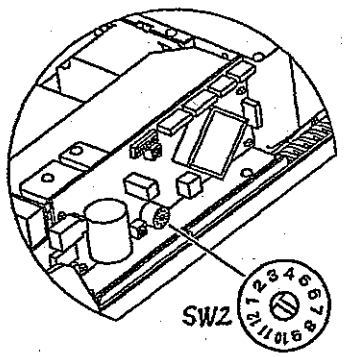
4. **Turn the power switch ON and project the chart onto the screen to check that the all visual acuities are displayed (or not displayed). (Check also the light leakage and chart blockage.)**
   * When light leakage or chart blockage is found, make fine adjustments of the VA mask position.

5. **Tighten BS3 × 6_{ZnC} securely and remount the top cover ASSY.**

6.6.3 Selecting the amount of chart light

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Turn the power switch ON and set the rotary switch (SW2) on the BA01 board with a flatblade screwdriver.**
   * The light amount has 5 levels. (See the right figure.)
   * Channel 6 is the same brightness as Channel 1.
   * The setting at shipment is Channel 2.



Channel	Chart brightness
1	300 cd/m^2
2	250 cd/m^2
3	200 cd/m^2
4	130 cd/m^2
5	100 cd/m^2

* These values are the brightness when the chart is projected on the attached screen at the refractive distance of 5 m.

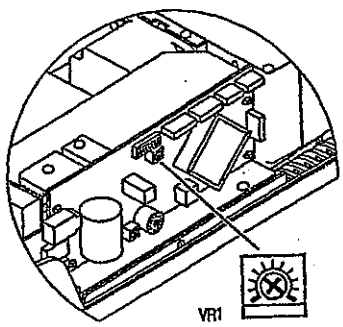
3. **Turn the power switch ON and project the chart on the screen to check that the chart brightness is suitable.**
   * Use the screen attached to the CP-690 main body.

4. **Remount the top cover ASSY.**

6.6.4 Setting of the beep sound volume (Response sound)

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Rotate the volume (VR1) on the BA01 board with a flatblade screwdriver.**
   * Rotating the volume clockwise makes the beep sound louder.
   * In order to check the beep sound volume, press the program next button on the remote control.



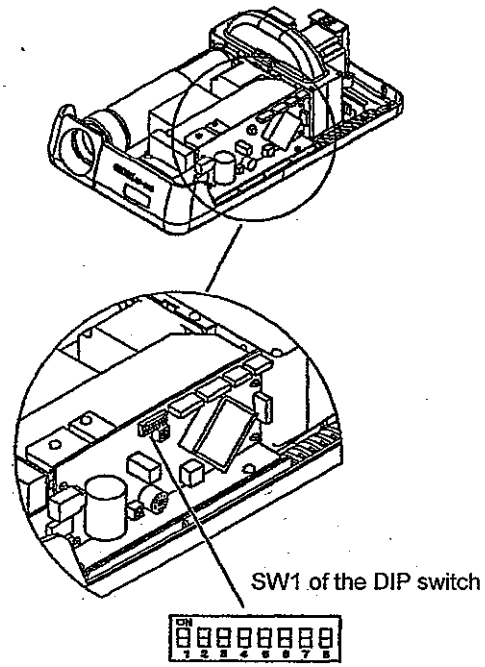
3. **Remount the top cover ASSY.**

6.6.5 Setting of the DIP switch

1. **Remove the top cover ASSY. (Refer to 5.1.)**

2. **Change the setting of the DIP switch (SW1) on the BA01 board.**
   * When turning the DIP switch to the ON or OFF position, slide the switch without loading the circuit board. If not, the board may fail.
   * See the table below as for each function of the DIP switch.

3. **Remount the top cover ASSY.**



[DIP switch functions of the BA01 board of the CP-690]

Switch No.	Function	OFF	ON
1	Setting of the channels of the remote control (For using several units)	According to the combination of the switch codes (See the table on the next page.)	
2			
3			
4	None	The setting is definitely OFF.	
5			
6	Changing of the automatic shutoff time of the lamp (When connecting the CP-690 to the RT-2100, the setting of the RT-2100 is put on a higher priority.)	15 minutes	5 minutes
7	Focused writing of program A	Not wiring	Wiring
8	Adjustment mode	The setting is definitely OFF.	

* All settings at shipment are OFF.

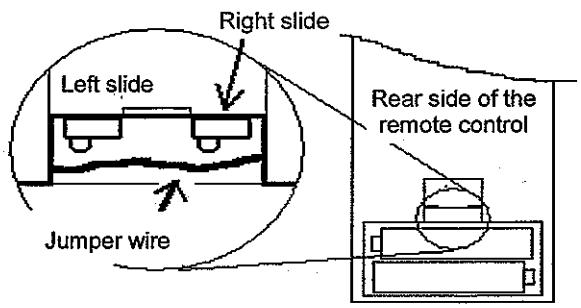
[Setting when using several units (Switch code setting)]

When several CP-690 units are used in the same room, set the switches of the main body and remote control according to the table below in order to prevent electrical interference of the remote control.

(When using the CP-690 with the RT-1200, set also the control box (CB) of the RT-1200.)

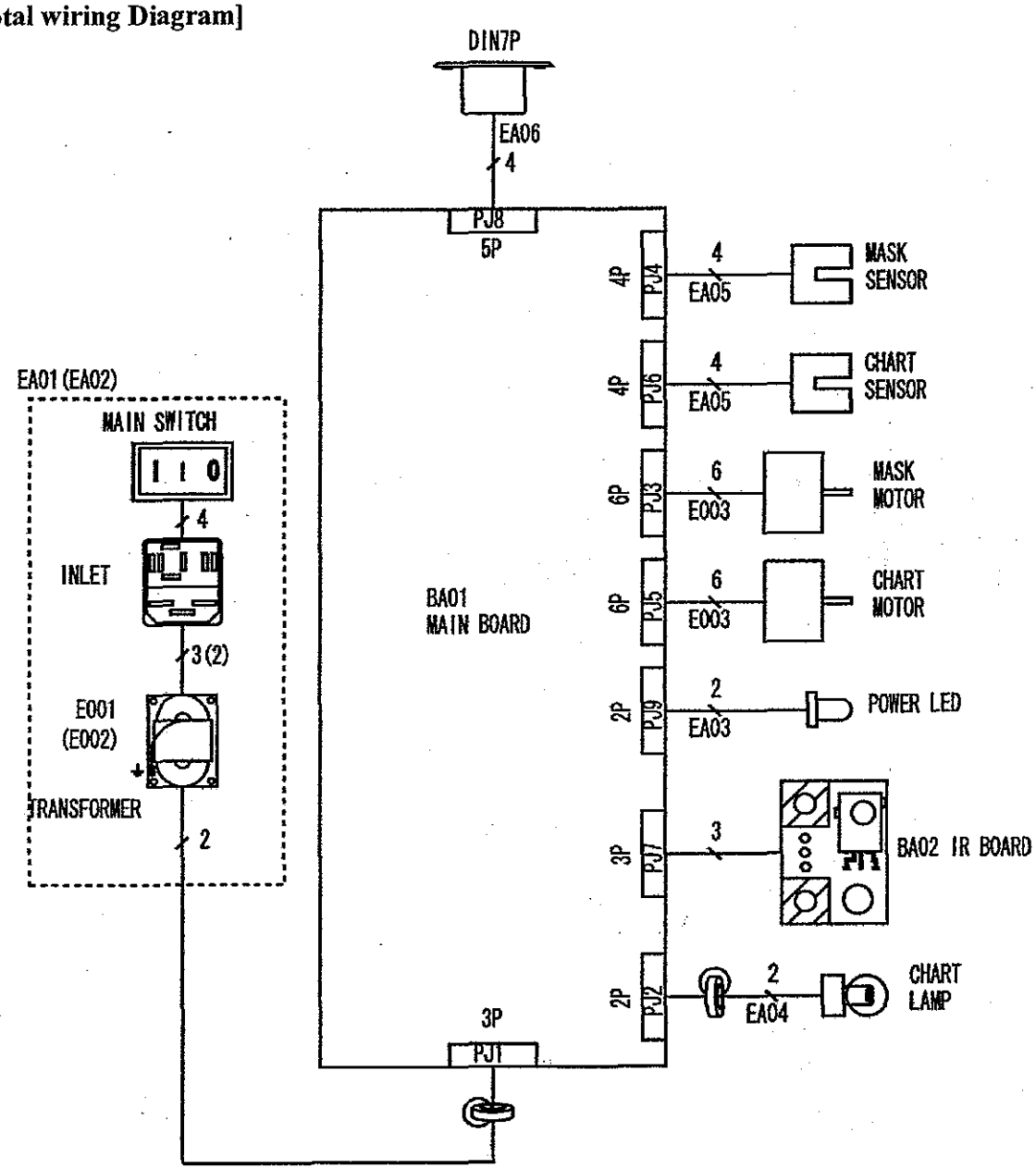
Switch setting	On the BA01 board of the CP-690 main body			In the battery box of the remote control as shown below			Rear side of the RT-1200CB	
	SW1	SW2	SW3	Left slide	Right slide	Jumper wire	SW2-8	SW2-7
1st unit	OFF	OFF	OFF	Leftward	Leftward	Connected	OFF	OFF
2nd unit	OFF	ON	OFF	Rightward	Leftward	Connected	OFF	ON
3rd unit	ON	OFF	OFF	Leftward	Rightward	Connected	ON	OFF
4th unit	ON	ON	OFF	Rightward	Rightward	Connected	ON	ON
5th unit	OFF	OFF	ON	Leftward	Leftward	Cut	OFF	OFF
6th unit	OFF	ON	ON	Rightward	Leftward	Cut	OFF	ON
7th unit	ON	OFF	ON	Leftward	Rightward	Cut	ON	OFF
8th unit	ON	ON	ON	Rightward	Rightward	Cut	ON	ON

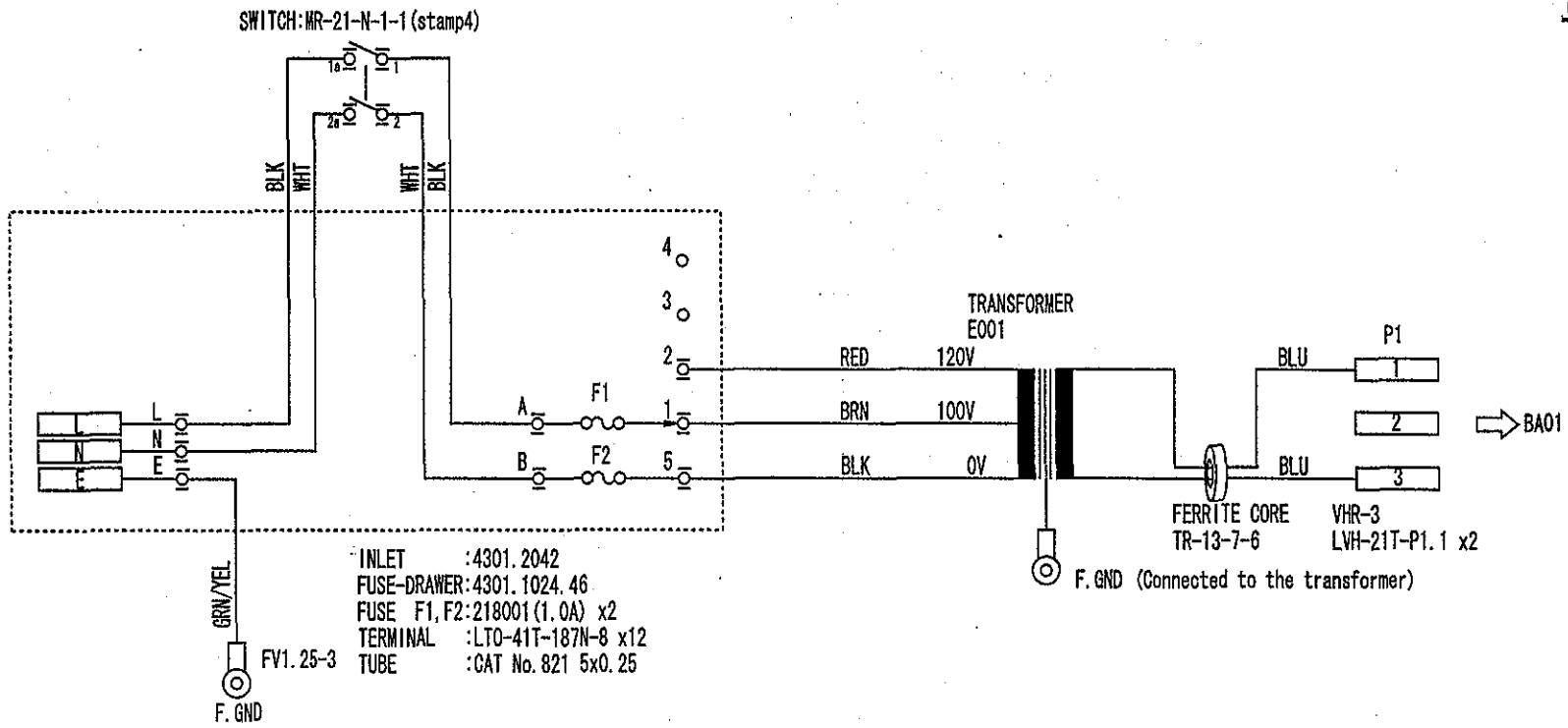
* The setting at shipment is the same as the 1st unit.
* The usage environment such as setting of the DIP switch of the RT-1200 and software is the same as the CP-670.
* When using the CP-690 with the RT-2100, the setting of the switch code is not necessary.
  (It can control the CP-690 with the RT-2100 regardless of the setting from SW1 to SW3 of the main body.)
  However, the switch codes of the main body and remote control need to be set in order to use the remote control.
* Select "CP-690 Type**" when selecting the visual chart of the RT-2100 control box.
* Once the jumper wire of the remote control is cut, it can not be reconnected. Only when using five units or more, cut the wire.

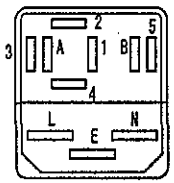


7.1 Wiring Diagram

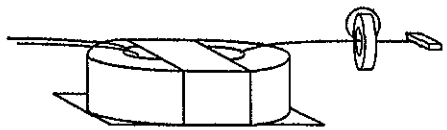
[Total wiring Diagram]

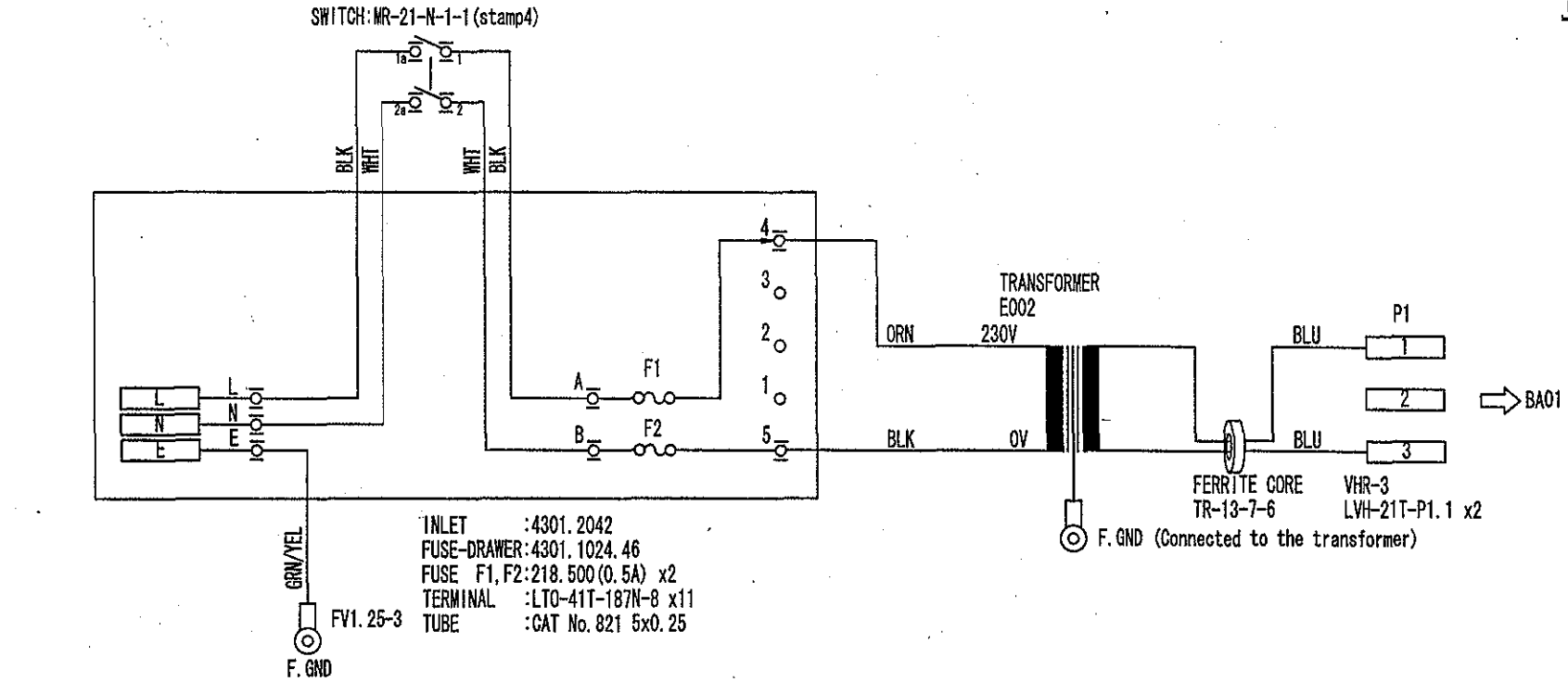


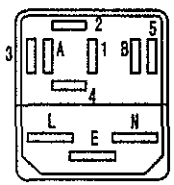




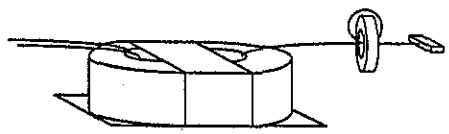
INLET
REAR VIEW



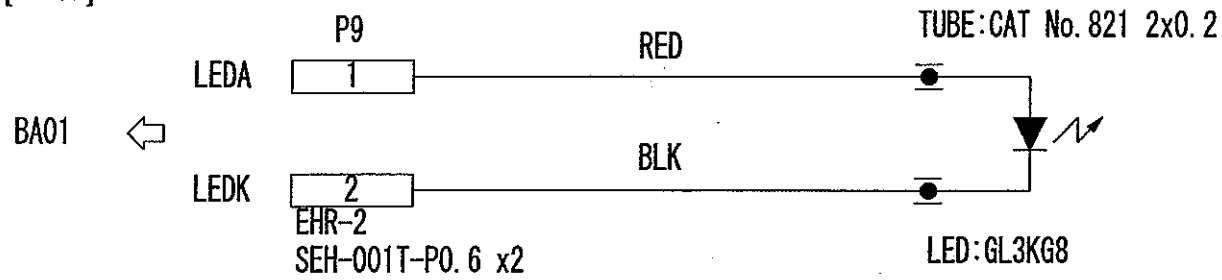




INLET
REAR VIEW

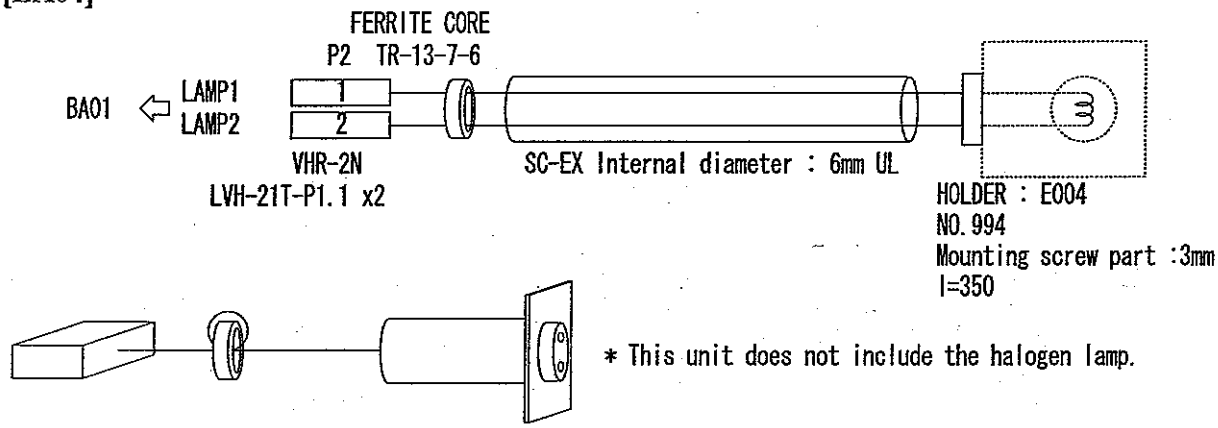


[EA03]

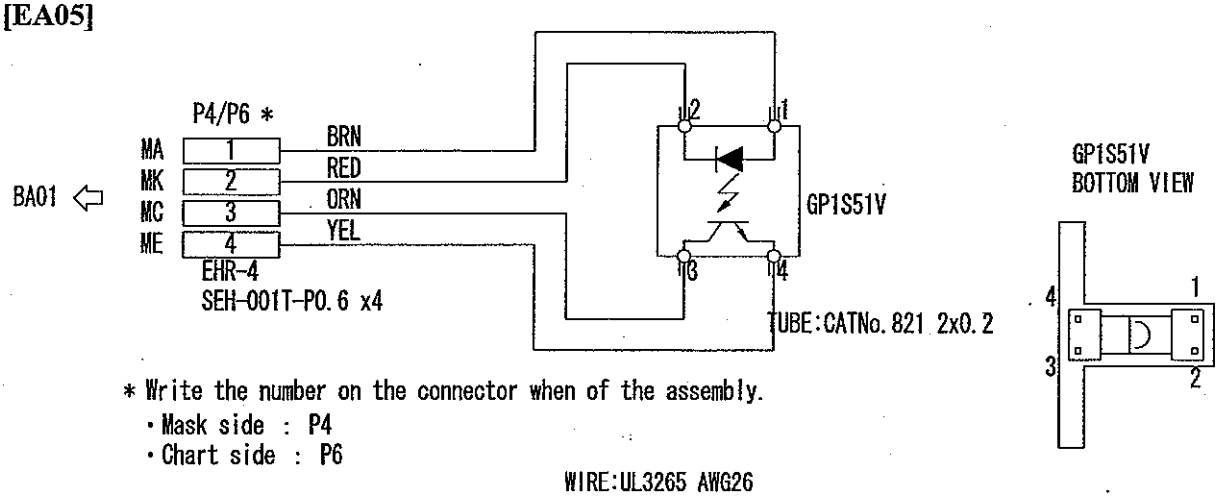


WIRE:UL3265 AWG26

[EA04]



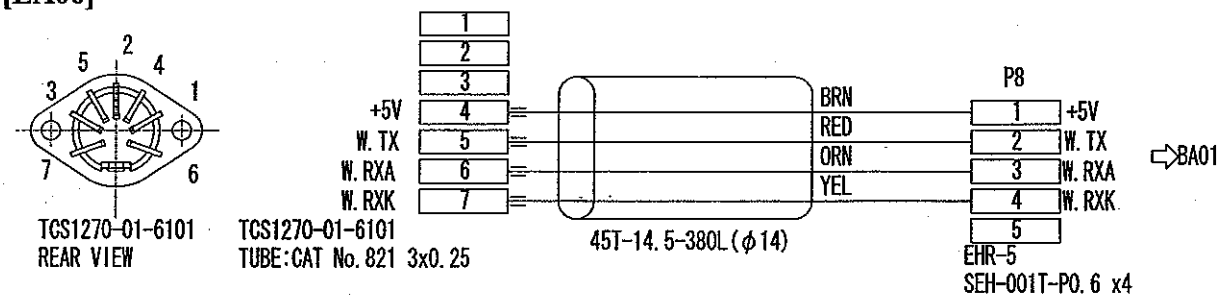
[EA05]



* Write the number on the connector when of the assembly.
  - Mask side : P4
  - Chart side : P6

WIRE:UL3265 AWG26

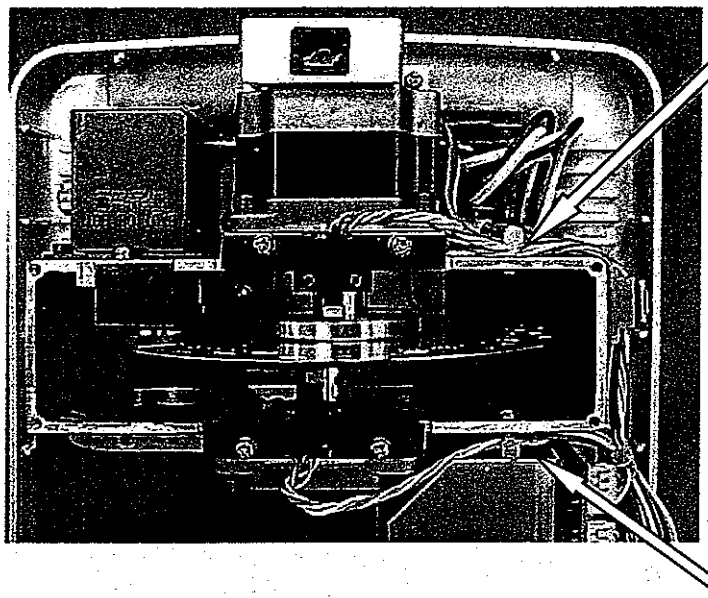
[EA06]



WIRE:UL3265 AWG26

7.2 How to Carry Out the Wiring

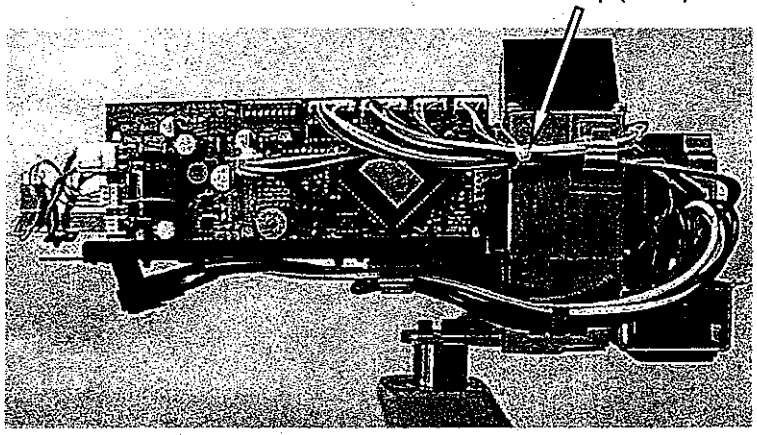
Carry out the wiring as follows and tie the wiring with a tie wrap (T18R) in the position "⇨".



Tie wrap (T18R)
Tie the cables of the mask motor and mask sensor. Draw the tie wrap through the hole of the disk housing.

Tie wrap (T18R)
Tie the cables of the chart motor and chart sensor. Draw the tie wrap through the hole of the disk housing.

Tie wrap (T18R)



§8 LIST OF REPLACEABLE PARTS

[U type]

Type	Parts name		Parts No.	Number	Remarks
Board	BA01 board (main board)		33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)		33155-BA02	1	
Parts	Power transformer	100 V system	33155-E001	1	Parts in EA01
		200 V system	33155-E002	1	Parts in EA02
	Motor (for chart/mask)		33155-E003	Each: 1	
	1 chip CPU (for U type)		33156-E100	1	
	Reflecting mirror		33156-G002	1	
	Fuse Slow-blow type	100 V system	80402-02039	2	1 A 250 V
		200 V system	80402-02037	2	0.5 A 250 V
	Seesaw switch		80460-00103	1	Parts in EA01
	Halogen lamp		80426-00069	1	
	Screen		33156-M050	1	
Unit	Lamp cable		33135-EA04	1	
	Sensor (for chart /mask)		33155-EA05	Each: 1	
	Bottom cover ASSY		33156-1010	1	
	Mask ASSY		33156-1100	1	
	C lens ASSY		33156-1210	1	
	Holder ASSY (30×)		33138-1300	1	
	Chart ASSY		33156-1400	1	
	Remote control ASSY	Nidek brand	33156-2030	1	
		Magnon brand	33156-2090	1	

[M type]

Type	Parts name		Parts No.	Number	Remarks
Board	BA01 board (main board)		33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)		33155-BA02	1	
Parts	Power transformer	100 V system	33155-E001	1	Parts in EA01
		200 V system	33155-E002	1	Parts in EA02
	Motor (for chart/mask)		33155-E003	Each: 1	
	1 chip CPU (for M type)		33156-E200	1	
	Reflecting mirror		33156-G002	1	
	Fuse Slow-blow type	100 V system	80402-02039	2	1 A 250 V
		200 V system	80402-02037	2	0.5 A 250 V
	Seesaw switch		80460-00103	1	Parts in EA01
	Halogen lamp		80426-00069	1	
	Screen		33156-M050	1	
Unit	Lamp cable		33135-EA04	1	
	Sensor (for chart /mask)		33155-EA05	Each: 1	
	Bottom cover ASSY		33156-1010	1	
	Mask ASSY		33156-1100	1	
	C lens ASSY		33156-1210	1	
	Holder ASSY (30×)		33138-1300	1	
	Chart ASSY		33156-3400	1	
	Remote control ASSY	Nidek brand	33156-2130	1	
		Magnon brand	33156-2190	1	

[F type]

Type	Parts name		Parts No.	Number	Remarks
Board	BA01 board (main board)		33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)		33155-BA02	1	
Parts	Power transformer	100 V system	33155-E001	1	Parts in EA01
		200 V system	33155-E002	1	Parts in EA02
	Motor (for chart/mask)		33155-E003	Each: 1	
	1 chip CPU (for F type)		33157-E100	1	
	Reflecting mirror		33156-G002	1	
	Fuse Slow-blow type	100 V system	80402-02039	2	1 A 250 V
		200 V system	80402-02037	2	0.5 A 250 V
	Seesaw switch		80460-00103	1	Parts in EA01
	Halogen lamp		80426-00069	1	
	Screen		33156-M050	1	
Unit	Lamp cable		33135-EA04	1	
	Sensor (for chart /mask)		33155-EA05	Each: 1	
	Bottom cover ASSY		33156-1010	1	
	Mask ASSY		33156-1100	1	
	C lens ASSY		33156-1210	1	
	Holder ASSY (30×)		33138-1300	1	
	Chart ASSY		33157-1400	1	
	Remote control ASSY	Nidek brand	33157-2030	1	
		Magnon brand	33157-2090	1	

[T type]

Type	Parts name		Parts No.	Number	Remarks
Board	BA01 board (main board)		33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)		33155-BA02	1	
Parts	Power transformer	100 V system	33155-E001	1	Parts in EA01
		200 V system	33155-E002	1	Parts in EA02
	Motor (for chart/mask)		33155-E003	Each: 1	
	1 chip CPU (for T type)		33158-E100	1	
	Reflecting mirror		33156-G002	1	
	Fuse Slow-blow type	100 V system	80402-02039	2	1 A 250 V
		200 V system	80402-02037	2	0.5 A 250 V
	Seesaw switch		80460-00103	1	Parts in EA01
	Halogen lamp		80426-00069	1	
	Screen		33156-M050	1	
Unit	Lamp cable		33135-EA04	1	
	Sensor (for chart /mask)		33155-EA05	Each: 1	
	Bottom cover ASSY		33156-1010	1	
	Mask ASSY		33156-1100	1	
	C lens ASSY		33156-1210	1	
	Holder ASSY (30×)		33138-1300	1	
	Chart ASSY		33158-1400	1	
	Remote control ASSY	NIDEK brand	33158-2030	1	
		Magnon brand	33158-2090	1	

[P type]

Type	Parts name		Parts No.	Number	Remarks
Board	BA01 board (main board)		33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)		33155-BA02	1	
Parts	Power transformer	100 V system	33155-E001	1	Parts in EA01
		200 V system	33155-E002	1	Parts in EA02
	Motor (for chart/mask)		33155-E003	Each: 1	
	1 chip CPU (for P type)		33159-E100	1	
	Reflecting mirror		33156-G002	1	
	Fuse Slow-blow type	100 V system	80402-02039	1	1 A 250 V
		200 V system	80402-02037	1	0.5 A 250 V
	Seesaw switch		80460-00103	1	Parts in EA01
	Halogen lamp		80426-00069	1	
	Screen		33156-M050	1	
Unit	Lamp cable		33135-EA04	1	
	Sensor (for chart /mask)		33155-EA05	Each: 1	
	Bottom cover ASSY		33156-1010	1	
	Mask ASSY		33156-1100	1	
	C lens ASSY		33156-1210	1	
	Holder ASSY (30×)		33138-1300	1	
	Chart ASSY		33159-1400	1	
	Remote control ASSY	NIDEK brand	33159-2030	1	
		Magnon brand	33159-2090	1	

[I type]

Type	Parts name		Parts No.	Number	Remarks
Boards	BA01 board (main board)		33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)		33155-BA02	1	
Parts	Power transformer	100 V system	33155-E001	1	Parts in EA01
		200 V system	33155-E002	1	Parts in EA02
	Motor (for chart/mask)		33155-E003	Each: 1	
	1 chip CPU (for I type)		33160-E100	1	
	Reflecting mirror		33156-G002	1	
	Fuse Slow-blow type	100 V system	80402-02039	2	1 A 250 V
		200 V system	80402-02037	2	0.5 A 250 V
	Seesaw switch		80460-00103	1	Parts in EA01
	Halogen lamp		80426-00069	1	
	Screen		33156-M050	1	
Units	Lamp cable		33135-EA04	1	
	Sensor (for chart /mask)		33155-EA05	Each: 1	
	Bottom cover ASSY		33156-1010	1	
	Mask ASSY		33160-1100	1	
	C lens ASSY		33156-1210	1	
	Holder ASSY (30×)		33138-1300	1	
	Chart ASSY		33160-1400	1	
	Remote control ASSY (NIDEK brand)		33160-2030	1	

[UK type]

Type	Parts name	Parts No.	Number	Remarks
Board	BA01 board (main board)	33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)	33155-BA02	1	
Parts	200 V system power transformer	33155-E002	1	Parts in EA02
	Motor (for chart/mask)	33155-E003	Each: 1	
	1 chip CPU (for UK type)	33161-E100	1	
	Reflecting mirror	33156-G002	1	
	Fuse, slow-blow type (200 V system: 0.5 A 250 V)	80402-02037	2	
	Seesaw switch	80460-00103	1	Parts in EA01
	Halogen lamp	80426-00069	1	
	Screen	33361-M080	1	
Unit	Lamp cable	33135-EA04	1	
	Sensor (for chart /mask)	33155-EA05	Each: 1	
	Bottom cover ASSY	33156-1010	1	
	Mask ASSY	33161-1100	1	
	C lens ASSY	33161-1210	1	
	Holder ASSY (25×)	33362-M4604	1	
	Chart ASSY	33161-1400	1	
	Remote control ASSY (NIDEK brand)	33161-2030	1	

[A type]

Type	Parts name	Parts No.	Number	Remarks
Board	BA01 board (main board)	33155-BA01	1	IC board, bridge diode, regulator IC, insulating sheet (each: 1 pc.)
	BA02 board (IR board)	33155-BA02	1	
Parts	100 V system power transformer	33155-E001	1	Parts in EA01
	Motor (for chart/mask)	33155-E003	Each: 1	
	1 chip CPU (for A type)	33162-E100	1	
	Reflecting mirror	33156-G002	1	
	Fuse, slow-blow type (100 V system: 1 A 250 V)	80402-02039	2	
	Seesaw switch	80460-00103	1	Parts in EA01
	Halogen lamp	80426-00069	1	
	Screen	33361-M080	1	
Unit	Lamp cable	33135-EA04	1	
	Sensor (for chart /mask)	33155-EA05	Each: 1	
	Bottom cover ASSY	33156-1010	1	
	Mask ASSY	33161-1100	1	
	C lens ASSY	33161-1210	1	
	Holder ASSY (25×)	33362-M4604	1	
	Chart ASSY	33162-1400	1	
	Remote control ASSY (NIDEK brand)	33162-2010	1	

§9 TOOLS AND MEASURING DEVICES

[Tools and measuring devices]

Phillips screwdriver set
Flatblade screwdriver set
Precision screwdriver set
Hexagonal-head wrench set
Nipper (For cutting tie wraps)
Long-nose pliers
Tweezers
Tester
Soldering iron
Penlight

[Others]

Threadlocking adhesive (Three Bond 1401B)
Liquid mixture (methanol 50% + ether 50%)
KIMWIPES (CRECIA WIPER S-200)
Blower
Solder
Heat sink grease (MIZUTANI ELECTRIC CO., LTD.)
Insulating tape (NITOFRON tape: NITTO No. 973UL Width: 19 mm)
Tie wrap (T18R)
Swabs
Lens cleaning paper